SEP 18 1957

ONSTRUCTION • OPERATIONS • MAINTENANCE

B 670552

PIPE LINE INDUSTRY

SEPTEMBER
1957

...NE COPY SENT

SPECIAL MAINTENANCE REPORT

SEP 26 1957

CLAMP-ON ANODES
Bury Submarine Lines and Forget 'Em 28

COMPLETE RECORDS
Reduce Your Field Maintenance Costs 32

CONTRACTOR'S YARDSTICK
Overhauls Can Signal Trade-In Time 36

CENTRIFUGAL CHECKLIST
Make Mechanical Seals Last Longer 44

BETTER PERFORMANCE
Chrome Plating Cuts Engine Ring Wear 48

SAFER OPERATIONS
Proper Planning Will Whip LPG Fires 51

For a "Quick Look" at this issue, turn the page .

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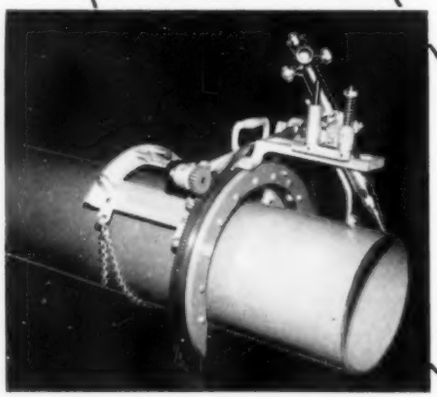
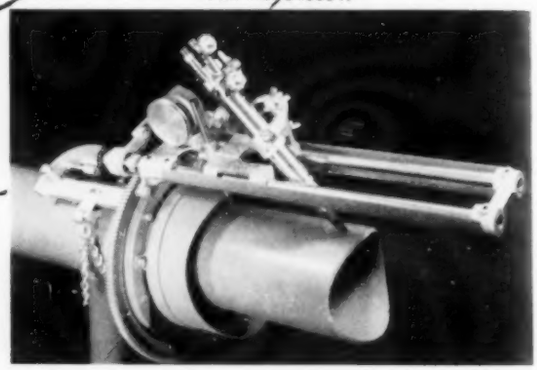
torch control . . .

NEW OUT-OF-ROUND
Patent Applied For



SHAPE CUTTER
Pat. No. 2408517



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PIPE LINE INDUSTRY

CONTENTS and Quick Look

September, 1957 Vol. 7, No. 3

To help you put first things first, scan these time-saving digests, checking ☑ those you want to read first.

SPECIAL MAINTENANCE REPORT

"Built-In" Anodes Protect Submarine Line

☐ Zinc sacrificial anodes will protect the center 10 miles of a 21-mile offshore line. Anodes, which are clamped to the pipe, will be buried as the line is laid. Installing the anodes in this manner does away with the necessity of future maintenance of the anode installation.

By A. L. Stegner and J. H. Baxter.....Page 28

Complete Maintenance Records Pay

☐ Good maintenance records make it possible to use past experience to prevent future troubles. This staff survey of several major oil and gas pipe line companies includes typical forms used to keep maintenance records.

By John C. Watts.....Page 32

When Should You Replace Machinery?

☐ Many of the expenses of maintaining pipe line construction equipment gets lost in the cost of a job. Here is a method to keep track of just how much a given piece of machinery is costing; well kept records can help you decide when it should be traded. Annual overhaul costs are a good indicator of working season maintenance expenses, too.

By Fred L. Baumann.....Page 36

Keep Engines Running Smoothly

☐ Here are some good trouble-shooting tips from the notebook of a Service Pipe Line Company supervisor. You can put them to work profitably in your own station preventive maintenance schedule.

By C. E. Hickey.....Page 41

Facts About Pump Packings and Seals (Part 4)

☐ This report will help you to locate the cause of seal troubles when they occur. Repair pointers are included for some of the more common ones. It is a valuable guide for the centrifugal pump maintenance man.

By Harold Woodhouse.....Page 44

Chrome Plating Reduces Engine Ring Wear

☐ Piston ring life can be extended up to 40,000 hours by chrome plating. Experience shows hard plating will not increase wear on cylinders.

By Helmuth G. Braendel.....Page 48

Controlling Fires of High VP Liquids

☐ Here is a report on a number of fires caused by improper handling of high vapor pressure liquids. A list of effective precautions that should have been taken will serve as a good guide.

By J. L. Risinger.....Page 51

What Training Should Include (Part 1)

☐ Here are all the ingredients you need to start and maintain a successful training program, as determined by a survey of 50 oil companies. In this timely report you will find a detailed analysis of the most effective ways to start a training program, how to determine courses to teach, plus a discussion of the levels to which training courses should be directed.

By Carl Mullins White.....Page 54

10 Ways to S-T-R-E-T-C-H Those Years

☐ In this busy world, health isn't given much consideration—until a person has lost it. Whether you are in the business or operational phase of pipelining, you will benefit from these 10 excellent ways to a longer, more enjoyable life.

By Ernest W. Fair.....Page 57

REGULAR MONTHLY DEPARTMENTS

Editorial Page	4
Pipe Line Panorama	27
Rules of Thumb	60
Construction News	63
Pipe Line Hints	78
Pipe Line Men in the News	86
Who's Meeting Where	90
What's Happening Among Service and Supply Men	92
What's New in Equipment	103
New Equipment Catalogs and Literature	116
ADVERTISERS' INDEX	118

PIPE LINE INDUSTRY published every month. Entered as second class mail matter July 9, 1954, at the post office at Houston, Texas, under the act of March 3, 1879.

Busy Times Ahead

There are no signs of any let up in the continuous rapid growth of the oil and gas industries. Everything points to further sharp expansion in the years ahead.

A recent study by Chase Manhattan Bank predicts oil consumption in the United States will rise from its 1956 level of 8.7 million barrels daily to 11.2 million barrels by 1961, and climb to 14.3 million barrels per day by 1966. The latter means consumption 10 years hence will be two-thirds greater than today's present high level.

A much higher rate of growth is predicted outside of the U. S., as other areas of the world become more industrialized and mechanized. The study forecasts Free World demand outside of the U. S. will reach 9.8 million barrels a day by 1961 and 14.2 million barrels by 1966. The latter would be more than double the 6.8 million barrels of oil consumed in 1956.

When the two sets of figures are put together it means a total Free World consumption of 21 million barrels per day is forecast for 1961, and 28.5 million barrels for 1966. In contrast, total Free World oil consumption in 1956 was but 15.5 million barrels a day.

It is significant, however, to realize that the 15.5 million barrels consumed by the Free World in 1956 was more than doubled the 7.1 million barrels consumed just 10 years ago. It also is noteworthy that whereas oil consumption of the Free World increased by 8.4 million barrels a day during the past 10 years, an increase of 13 million barrels in daily consumption is forecast for the coming 10 years.

To these imposing figures must be added prospects for natural gas, which is too closely associated with oil to be separated. Studies by Chase Manhattan Bank predict the U. S. will be consuming 16.0 trillion cubic feet of natural gas annually by 1966. This would be 5.9 trillion cubic feet or 58 percent above the 10.1 trillion consumed in 1956. The latter was 5.9 trillion cubic feet greater than consumption 10 years ago. In other words, future growth is expected to continue at rates equal to the spectacular pace of recent years.

Further great expansion, therefore, lies ahead of the oil and gas industry. It will be necessary that recent record-breaking expenditures of the industry be continued in coming years. This will include large scale investments in new pipe line facilities.

During the recent Suez Canal blockade it was proved the U. S. did not have adequate pipe line facilities to ship large additional amounts of crude oil. Therefore, to make sufficient supply available to satisfy higher future oil consuming rates it will be necessary that large additional investments be made in expanded pipe line facilities in coming years.

Although natural gas now is piped to all large consuming regions of the U. S., this does not mean large scale gas line construction is at an end. If U. S. natural gas consumption is to increase by anything like the 5.9 trillion cubic feet in the next 10 years, much additional construction will be necessary.

With demand for oil expected to grow much more rapidly outside of the U. S., it is logical to expect production outside the U. S. will grow at faster rates. This will call for greater crude oil pipe line construction abroad than in the past.

These prospects mean busy times are ahead of the oil and gas pipe line industry. Recent heavy construction programs must be continued in coming years.

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PIPE LINE INDUSTRY and the PIPE LINE COMPOSITE CATALOG for the oil and gas pipe line industry.

WORLD OIL and THE COMPOSITE CATALOG for the drilling-producing-pipe line industry.

PETROLEUM REFINER and THE REFINERY CATALOG for the refining-natural gasoline-petrochemical industry.

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R. M. DE Sombre, Circulation Manager, P. O. Box 2608, Houston 1, Texas, U. S. A.

Single copies 50 cents (except special issues).

Double price for single copies more than a year old. Subscription price: domestic and foreign $2 a year; 2 years, $3; 3 years, $4. Subscription restricted to those engaged in the pipe line branch of the oil and gas industry, or the manufacturing and distribution of pipe line equipment.

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Indexed by Engineering Index and Industrial Arts Index

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ONE grease with MANY uses

Humble's Multi-Purpose Grease H covers the widest possible range of applications. It is a lubricant that equals or surpasses the quality of every single-purpose grease that it replaces. Your transportation and field storage problems are greatly reduced because you require only *one* lubricant instead of a different grease for each specific use.

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Humble Oil & Refining Co.
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Houston 1, Texas

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TUBE-TURN® Fittings speed up area measurement program

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- Just set it and start it
- Stops flow smoothly at preset gallonage
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Whether you're considering a new Brodie *Quantrol* installation — or converting existing Brodie *BiRotor* Meters to safe, automatic SHOCK-FREE Shutoff, contact your nearest Brodie Specialist today.

ON EVERY LINE FROM 2" to 8"—Capacities 100 to 1300 gpm—Working pressures to 150 psi

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Now you can have

maximum protection

for every inch of underground piping with

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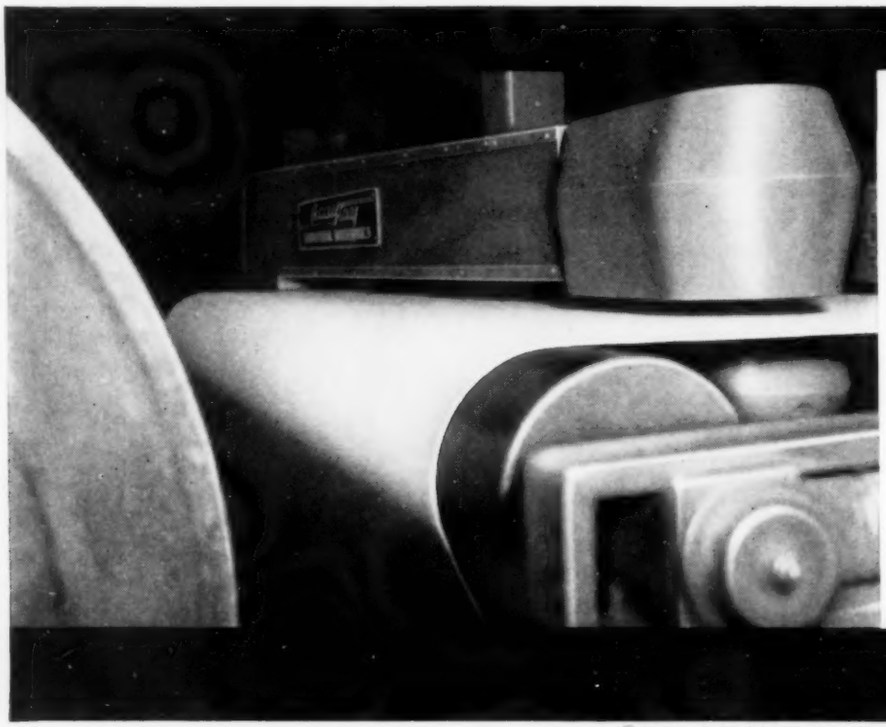
asbestos pipeline felt



only 4% weight variation in 30,000 miles of felt — thanks to new **AccuRay**® process!

This AccuRay control system has watch-dogged the manufacture of more than 30,000 miles of Carey Pipeline Felt. During this time the average weight variation in the felt has been less than 4%—compared to the usual 30% average for standard quality control methods.

® Trade mark of Industrial Nucleonics, Inc.—originators of this advanced nucleonic process for measuring thickness.

Every inch of underground pipe is subjected to soil stress. One weak spot in 100 miles of piping can be mighty costly—and so can any weak spots in the felt that protects this piping. That's why it's just good business to choose the pipeline felt that gives you the greatest uniformity of weight, thickness and strength for maximum protection against corrosion.

Only Carey, of all pipeline wrapping manufacturers, can offer you this uniformity—because only Carey Asbestos Pipeline Felt is weight-controlled by nucleonic AccuRay. There can be no *weak spots* to cause you repair headaches in years to come.

Why not ask your Carey Sales Engineer for the full story on the new Carey Asbestos Pipeline Felt with AccuRay, or write Dept. PLI-97 in Cincinnati.

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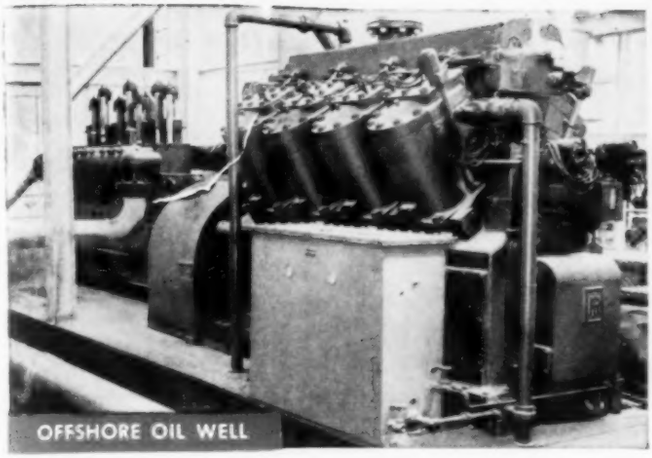
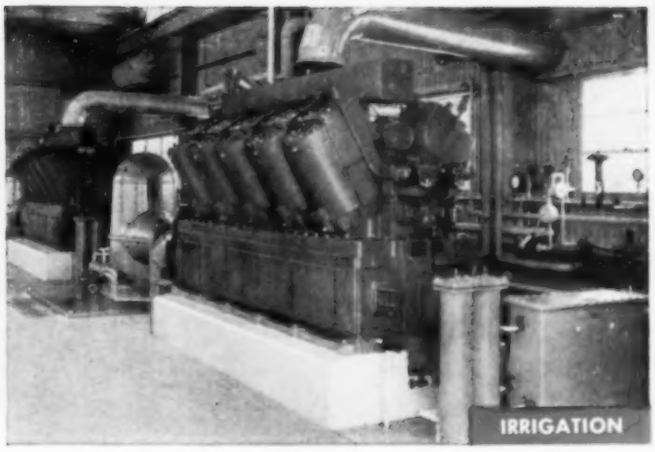
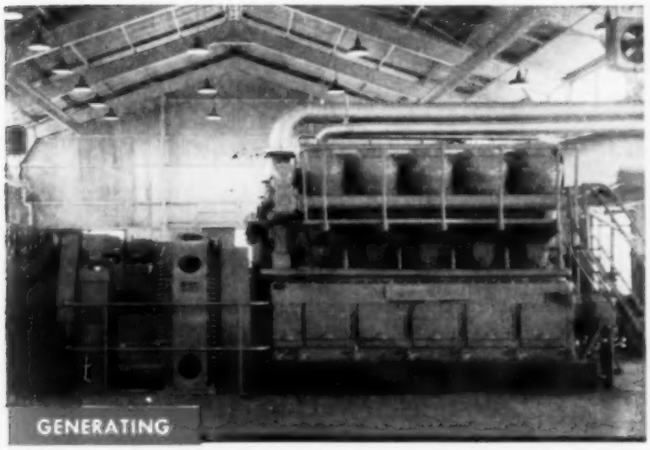


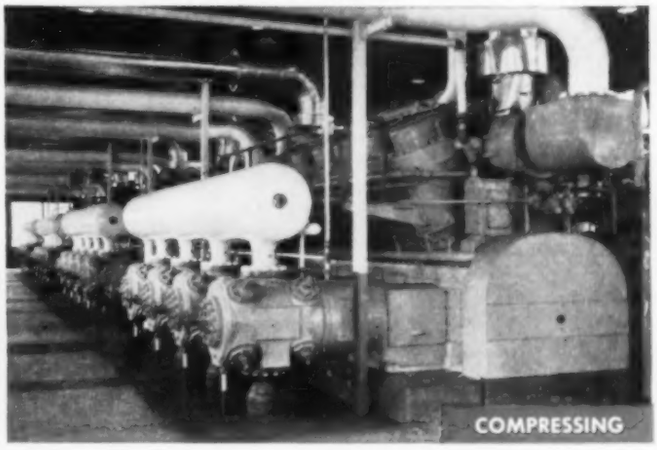
This 295-hp PJVG gas engine is mounted on a platform in the Gulf of Mexico driving a reciprocating crude oil pump. PJVG engines are built in 220 and 295-hp sizes.



The 680-hp PSVG units above are driving Ingersoll-Rand centrifugal pumps on a large irrigation project. PSVG gas engines cover the 408-816-hp range.



This 1100-hp PKVG is shown at the task most frequently assigned to I-R power units: a-c generator drive is a natural for smooth-running I-R 4-cycle gas engines. PKVG's are available from 880 to 1760 hp.



All I-R gas engines are also offered in integrally-built engine-compressor units. Above are 2000-hp turbo-charged KVS compressors on gas transmission. 4-cycle engine-compressors are available from 120-2000 hp.

POWER for any purpose

gas engines deliver heavy-duty power economically

Whatever the task, Ingersoll-Rand heavy-duty 4-cycle gas-engine equipment offers the highest dependability, flexibility and long-run economy. Built for 24-hour-a-day, continuous operation on a wide range of fuels, these engines are especially suitable where close control is important (such as a-c generator drive). Where I-R power units and their companion engine-compressors are used together, the similarity of operation and the interchangeability of parts effects additional important economies. Contact your I-R representative now for more information.

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Teletypewriters give Shell dispatcher immediate readings from four remote pumping stations

"New Douglas station suction 60 pounds, discharge 600 pounds, motor load 100 amps . . ." that's what the teletypewriters above tell Shell Oil Company's Indianapolis dispatcher about operations at an unattended pumping station over 200 miles away.

Bell System private line teletypewriters connect the dispatcher with four remote stations on Shell's "east line," which carries 33,000 barrels a day from the Wood River, Ill., refinery to Illinois, Indiana and Ohio markets.

The dispatcher simply pushes the proper buttons and the distant station is instantly on the circuit. Data on the remote operation is then received on his teletypewriter. By pushing other buttons, he can also start and stop pumps at the locations.

* * * *

Accuracy, reliability and speed are three reasons private line services are widely used in the pipeline industry. A Bell System representative will gladly give you more information, study your own requirements at no cost to you. Just call your Bell Telephone Company business office.

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HOW TO

CUT VALVE MAINTENANCE COSTS

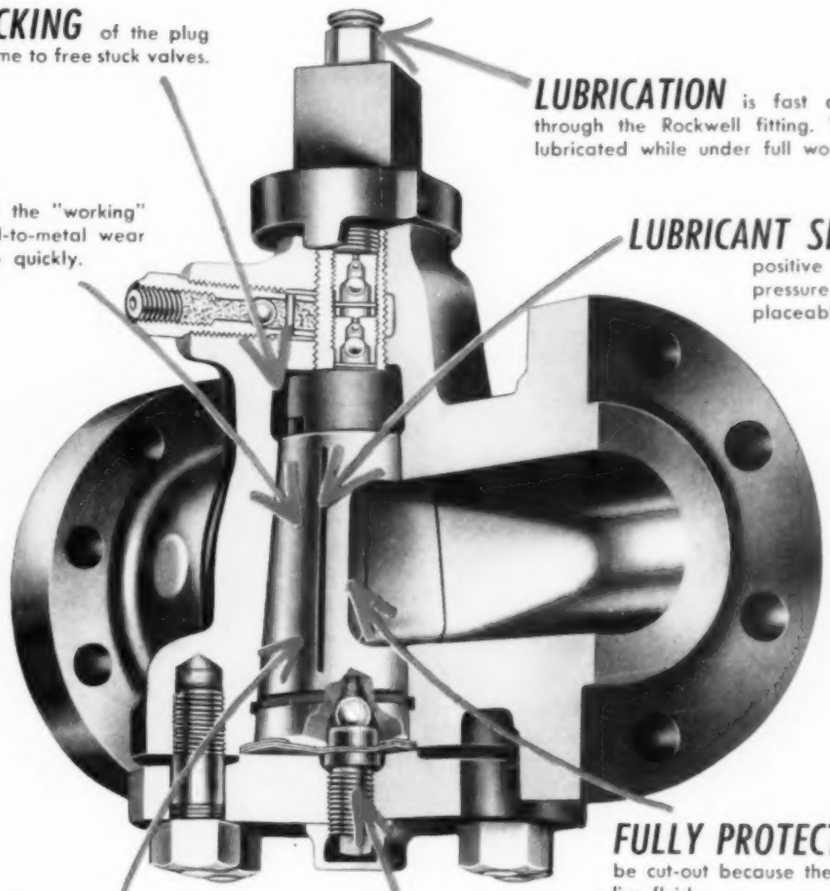
One proven way to cut pipeline valve costs is to specify Rockwell-Nordstrom lubricated plug valves. Look at the drawing below for just a few of the basic reasons why they will save you maintenance and down time dollars everywhere you use them.

LUBRICANT JACKING of the plug eliminates costly down time to free stuck valves.

LUBRICATION is fast and fool-proof through the Rockwell fitting. Valve can be lubricated while under full working pressure.

LUBRICANT PROTECTION on all the "working" surfaces prevents the metal-to-metal wear that ruins other valves so quickly.

LUBRICANT SEALING insures positive shut-off at any pressure . . . an instantly replaceable soft seat.



FULLY PROTECTED SEATS can't be cut-out because they're never exposed to line fluids.

SELF-ADJUSTING, tapered plug insures perfect seating far longer than ordinary valves.

IN-SERVICE ADJUSTMENT is fast and easy and never interrupts flow.

USE ONLY GENUINE ROCKWELL-NORDSTROM VALVE LUBRICANTS

Rockwell-Nordstrom pipeline valves are available in a full range of sizes and pressures. Also, a full line of power operators and accessory equipment is available to answer every flow control need. For complete information, write: Rockwell Manufacturing Company, Pittsburgh 8, Pa. Canadian Valve Licensee: Peacock Brothers Limited.

ROCKWELL-Nordstrom VALVES

Lubricant Sealed for Positive Shut-off

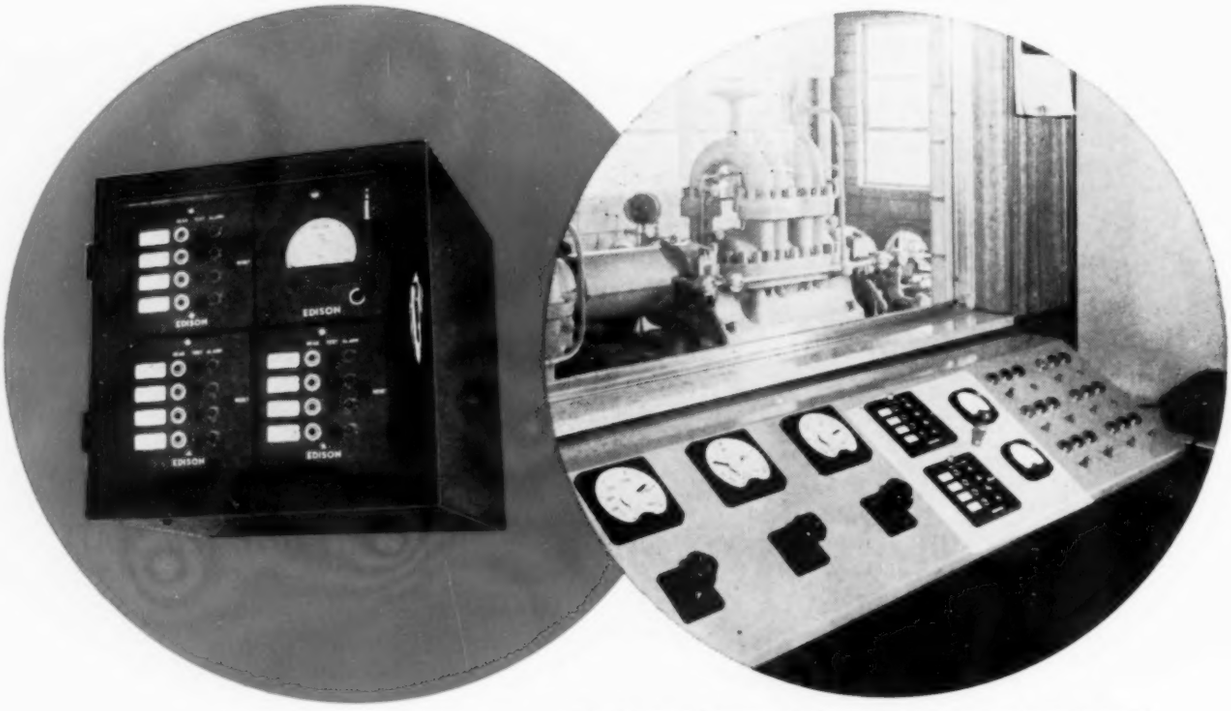
For more data on advertised products, use Readers' Service Cards, last page.

HOW EDISON'S OMNIGUARD PREVENTS PUMPING STATION SHUTDOWN FOR SUN OIL

Booster station shutdowns are prohibitively expensive. At the Sun Oil Company's pumping station at Rochester, Michigan, crude oil is pumped 24 hours a day, 7 days a week from Toledo, Ohio to Canada. One motor or pump shutdown would cost Sun Oil thousands of dollars in both maintenance and production costs.

The Edison Omniguard is used by Sun Oil for alarm and control purposes in connection with the operation of two major pieces of equipment — a 500 hp motor and a 6 stage centrifugal pump. Seven points are under constant surveillance by the Omniguard apparatus; namely, the two motor bearings, the two pump bearings, the two pump seals, and the pump case.

The alarm system at each point is pre-set for a given temperature, automatically warning the operator of any rise in temperature beyond the pre-set point and simultaneously shutting down the unit to prevent damage to major equipment in the pump station. All Omniguard temperature controls are located in a desk type console installed in the control room.



The following Omniguard features prompted Sun engineers to specify it for the Oakland installation:

1) Fast response
2) Quick adjustment of pre-set points
3) Ability to alarm and/or shut down selected points
4) Small physical dimensions of the sensing element
5) Explosion-proof construction at sensing element
6) Associated equipment can be installed immediately

Write for more technical details to:

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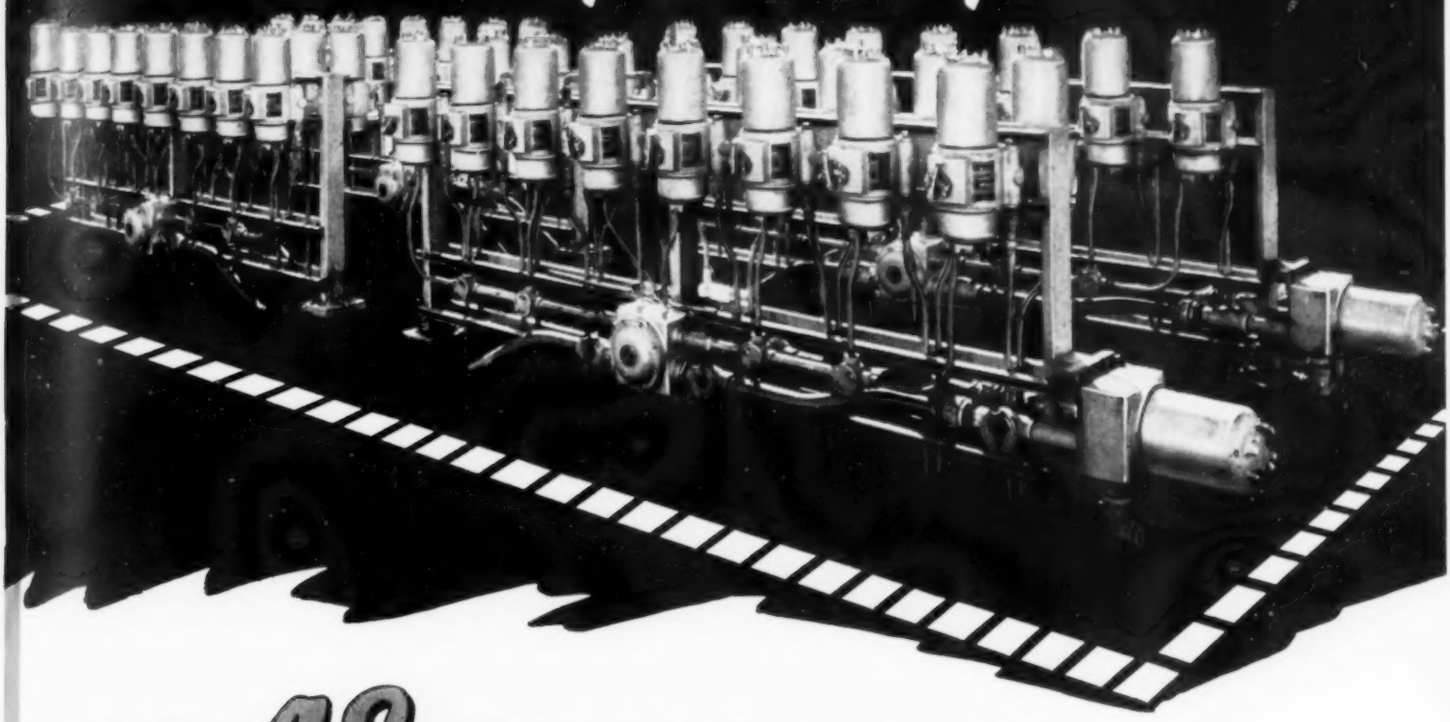
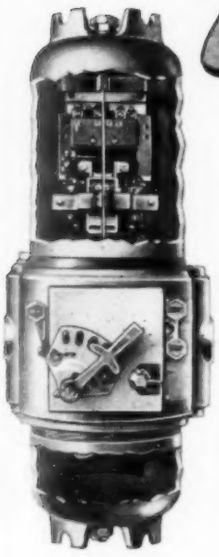
INDUSTRIES
INSTRUMENT DIVISION
96 LAKESIDE AVENUE
WEST ORANGE, N. J.

CROUSE-HINDS
Condulet* motor controls
Occupy Less Space!





48 **Explosion-Proof Combination Motor Starters and Circuit Breakers . . . *in a 25 ft. x 6 ft. Area!***

Crouse-Hinds Condulet* Type EPC Motor Starters and Circuit Breakers are explosion-proof, dust-tight (dust-ignition-proof) and weather-resistant (raintight).

Lightweight cast aluminum construction for easy installation without use of lifting equipment.

Seven Conduit entrances simplify installation.

Built-in push button stations and selector switches are available.

Starter sizes 0 to 5. Circuit breakers 50 to 600-amp. frame sizes.

In the installation shown above, 48 Crouse-Hinds Condulet* Type EPC combination motor starters and circuit breakers are compactly arranged in four racks.

If necessary, the 25 ft. x 6 ft. area used could have been cut in half by installing the Condulet motor controls in two tiers. Or, *twice* as many Condulet controls could have been installed in the same area, if required.

The *vertical design* of Crouse-Hinds motor starters, circuit breakers and combinations allows them to be installed only ¼" apart. This compactness produces savings in the construction of steel mounting racks, and in the use of premium floor space.

● **For help in solving a space problem, see your Crouse-Hinds distributor . . . or call the nearest Office listed below**

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FAST PACE SET BY INTERNATIONAL

Speeds completion of new

One of two Flagg International TD-14 dozers working here is shown backfilling behind the lowering-in operation to speed clean-up operations.

AL

SUPERIOR SIDEBOOMS

w gas distribution system

Working on a 16-mi. stretch from Medina to Lockport, N.Y., this TD-14A boom tractor puts 3,000-ft. of 10-in. pipe in the trench each shift for the Flagg Co. The new TD-14 sideboom on this job lifts 32,950-lb. at 4-ft. overhang.

The New York Electric & Gas Corp. is rushing natural gas to users in and around Lockport with a new distribution pipeline network that will be completed before Christmas. This year more than 60 miles of new mains and service lines, from 16- to 1-inch, are being placed.

C. N. Flagg & Co., Inc., Albany, N.Y., has the prime contract for the improvement. This firm specializes in all types of pipelining throughout New York as well as three New England states. And on all of its scattered operations, the Flagg firm relies on International Superior sideboom tractors to meet or beat completion dates.

Jack Chaney, Flagg's area manager at Lockport, tells why: "I'm getting up to 3,000 ft. of pipelaying production daily from the three International Superior TD-14 and TD-9 sidebooms on this job. All are doing more than an adequate job. In my 15 years around Internationals I've noticed how design changes constantly improve the efficiency, safety, and ease of operation of these machines. And they stay on the job, too!"

Whether you lay service lines or big-inch pipe, you can get convincing performance proof of International Superior sideboom advantages by calling your International Construction Equipment Distributor. He's prepared to lay it on the line and demonstrate, whenever you say. Ask to see an International Superior TD-24, TD-18, TD-14, or a TD-9 in action. Then you'll see how any bonus-powered International Superior sideboom gives you a decisive margin of pipelaying power for your equipment dollar.

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Remote supervision of Pipeline Booster Stations

. . . . with Pulse Beat telemetering!

REMOTE PUMP CONTROL • REMOTE VALVE CONTROL • TANK LEVELS
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As part of a supervisory control system . . .

- **it is inherently suitable for integration into data reduction and tone transmission systems.**
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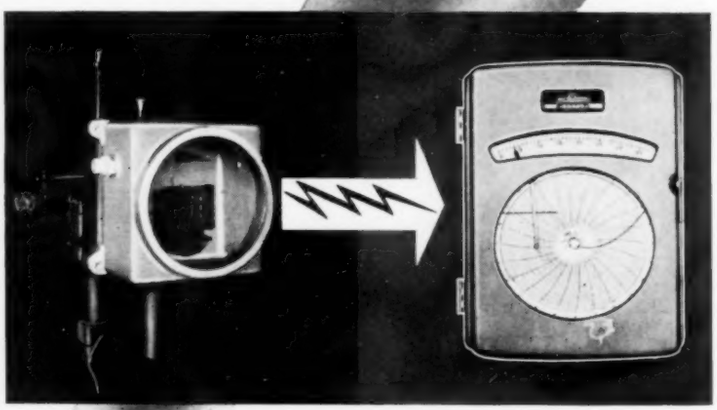
Act today! Request Bulletin 230-H4A for complete data. Let Builders application engineers help with your metering-control problems.

Write **Builders-Providence, Inc., (an associate of Proportioneers, Inc.) 545 Harris Avenue, Providence 1, Rhode Island.**



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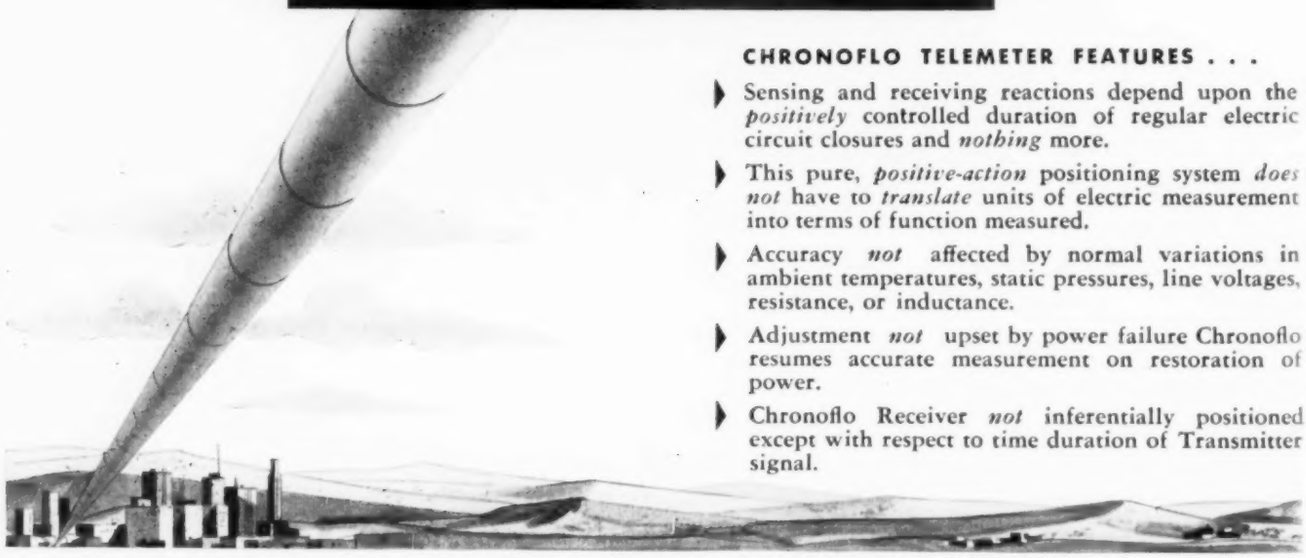
- This pure, *positive-action* positioning system *does not* have to *translate* units of electric measurement into terms of function measured.
- Accuracy *not* affected by normal variations in ambient temperatures, static pressures, line voltages, resistance, or inductance.
- Adjustment *not* upset by power failure Chronoflo resumes accurate measurement on restoration of power.
- Chronoflo Receiver *not* inferentially positioned except with respect to time duration of Transmitter signal.



BUILDERS-PROVIDENCE
DIVISION OF
B-I-F INDUSTRIES
METERS FEEDERS CONTROLS

QUICK

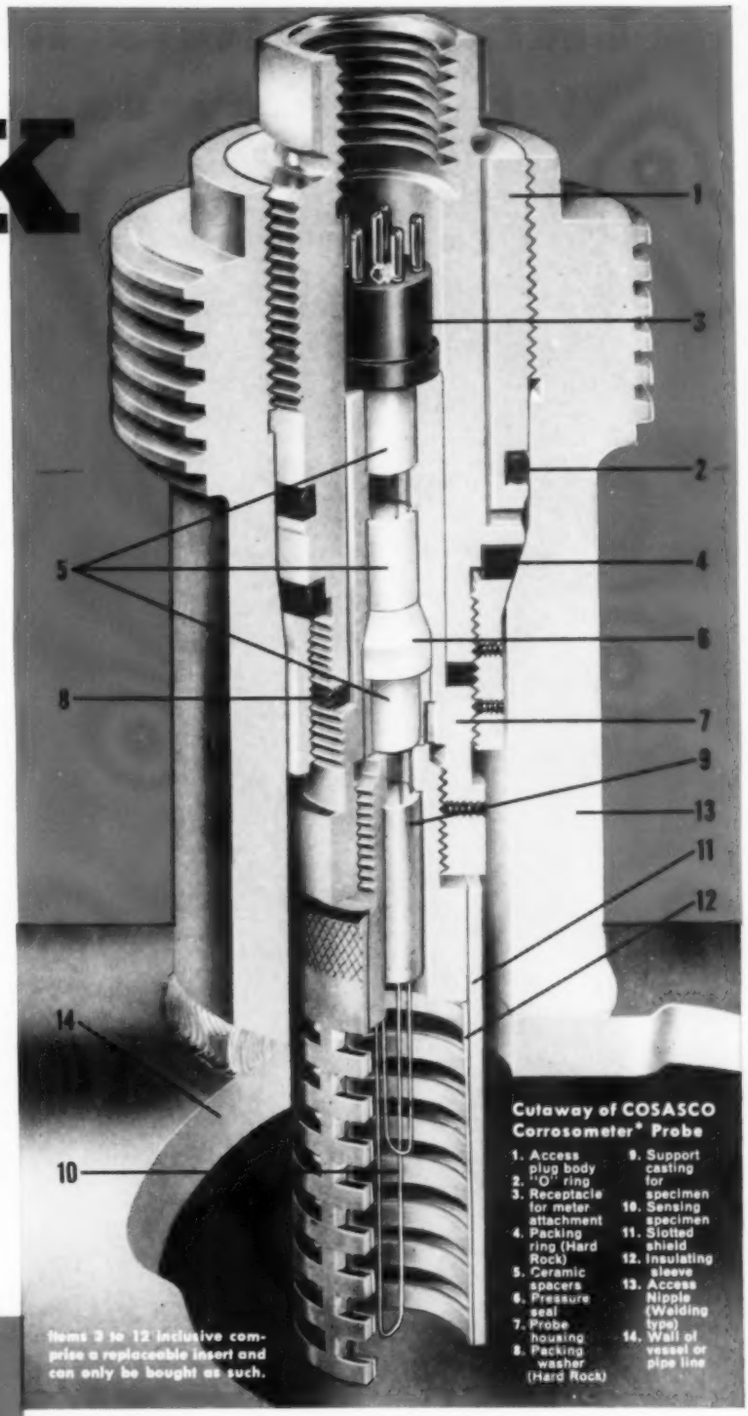
...corrosion readings while on stream...at full operating pressure

Corrosion engineers can now quickly detect and measure rate of corrosion of surfaces within pipe lines, processing vessels and receptacles, without interfering with operations...with this new COSASCO Corrosometer* Probe. Wherever a COSASCO *Access* Nipple can be installed, this probe can be inserted against full operating pressure, for sensing corrosion.

With a special meter connected to the probe, corrosion readings in increments of microinches can be made in as short an interval as 30 seconds. Effects of remedial programs can be determined in days instead of months!

Readings are based on the increase in electrical resistance of a metal specimen as corrosive attack reduces electrical conductivity. Accurate readings are obtained when the specimen is of the same metal as the surface under study.

The Corrosometer* Probe is one of several specialized COSASCO *Access* Plugs adapted to corrosion investigation. They include coupon-holder, water-sampler, thermocouple, and hydrogen-probe plugs. All can be supplied in the same OD for interchangeability.



Items 3 to 12 inclusive comprise a replaceable insert and can only be bought as such.

Cutaway of COSASCO Corrosometer* Probe

1. Access plug body
2. "O" ring
3. Receptacle for meter attachment
4. Packing ring (Hard Rock)
5. Ceramic spacers
6. Pressure seal
7. Probe housing
8. Packing washer (Hard Rock)
9. Support casting for specimen
10. Sensing specimen
11. Slotted shield
12. Insulating sleeve
13. Access Nipple (Welding type)
14. Wall of vessel or pipe line

Corrosometer* Meter and Power Pack, line or battery operated.

Is Operating Pressure Keeping You Out?

If you have an entry-against-pressure problem, COSASCO engineers can help you overcome it. Send details and blueprints depicting your problem and the COSASCO solution will be supplied promptly and without any cost to you whatsoever. *Write directly to* COSASCO Division of Perfect Circle Corporation, at the address below.

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For more data on advertised products, use Readers' Service Cards, last page.

TRENCHING MOVES FAST

When Bucyrus-Eries Move In

Trenching for a 24-in. natural gas pipeline in northern Pennsylvania near Honesdale is this Bucyrus-Erie 22-B dragshovel. The high pace this machine has set for its owner, Oklahoma Pipeline Constructors, Dallas, Tex., is characteristic of the features that have made Bucyrus-Erie dragshovels outstanding.

There's high speed on the hoist and swing as well as full digging power for heaped, quick-filling loads. The cambered boom provides added clearance for digging deep trenches, makes dumping easy because dipper can be raised high and brought in close without spilling the load. The dipper has sloping sides and extended lip area for clean loading and dumping.

Tractor-type crawler mounting is available, too, for top mobility. It raises ground clearance enough to travel over rocks, stumps, and most other obstructions. Deep grousers on the tractor-type treads provide sure traction in soft ground and permit the machine to climb steep grades. Special seals protect track-roller bearings against damage from water, dirt, and grime.

For more information on the high-output features of Bucyrus-Erie ½-yd. 15-B, ¾-yd. 22-B (both available with tractor-type crawlers), and new 1-yd. 30-B dragshovels, see your Bucyrus-Erie distributor today. 384E57

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You are free from weathered-out or flooded-out lines.

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YOU CAN BE SURE...IF IT'S

Westinghouse

Holiday Detection is an important step in checking a coating job before it goes below ground. But it's *after* the line is laid that the real test of how well the coating material will withstand the attack of water and soil chemicals begins. That's why coal-tar enamel is used on most important pipelines: it has proved its ability to provide long-term protection of pipeline investment.

Concrete "Corrodes," Too, under the attack of acid or alkaline solutions. Concrete underground is especially subject to deterioration: that's why this new sewer pipe is being protected with two coats of Bitumastic Super Service Black.

New Bulletin describing the important role of protective coatings in preventing corrosion is available. Request your copy by coupon below.

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Pittsburgh 19, Pa.

Please send me "The Fight Against Corrosion."

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how to
CUT CORROSION LOSSES
a report by Koppers Company, Inc.

Number 10 of a series

Dr. W. F. Fair, Jr.
Corrosion Consultant

Since the security of a multi-million dollar investment is at stake, preventing corrosion in buried steel pipelines is extremely important. In this field the decisions made as to corrosion-prevention practice in the *design* phase are irrevocable—and can prove tremendously expensive if wrong.

* * *

Hot applied coal tar enamels have been traditionally the primary part of the protection system on pipelines. In recent years, cathodic protection has become widely accepted as a supplement to coatings.

Enamels must now be judged as much on their value as long-term insulating materials as on their ability to prevent corrosion.

* * *

The best clue to a coating's performance is its ability to resist penetration by water. It is this inherent characteristic that determines a coating material's performance underground, with or without supplementary cathodic protection. As a coating absorbs water, it provides a decreased resistance to the flow of electric current between pipe and soil which is part of the corrosion process. Ultimately, water absorption leads to coating deterioration, which exposes bare pipe. In conjunction with cathodic protection, the coating system's most important function is that of a long-lasting electrical insulator so that impressed current requirements are kept to a minimum. Here too, a coating system's resistance to water penetration determines its performance. Actual pipeline operating experience has shown that the cost differential between maintaining cathodic protection on well and poorly insulated lines can amount to hundreds of thousands of dollars yearly.

* * *

Independent laboratories and industrial researchers have expended considerable time and effort in determining water absorption rates of protective coatings. Long-term tests have demonstrated, without exception, that coal-tar enamels have the highest resistance to water absorption among protective coating materials commercially available today.

The key to a coating's ability to resist water absorption seems to depend on the inherent molecular structure of the base material. The relative performance of a number of coatings in these various tests indicates that coating impermeability depends upon *aromatic content*. Coal tar enamel binders with an aromatic content in excess of 90%, show excellent water resistance in all tests while less aromatic materials show comparably poorer performance. Materials high in paraffinic content have been shown to leach under extended immersion.

* * *

An audio-visual meeting presentation discussing this important subject in detail is available. If you are interested in having a group-showing of this material—which includes a sound film—please address your inquiries to "How Long Should A Pipeline Last?," Koppers Bldg., Pittsburgh 19, Pa. or to Koppers District Offices: Boston, Chicago, Los Angeles, New York, Pittsburgh and Woodward, Ala. In Canada: Koppers Products, Ltd., Toronto, Ontario, and Edmonton, Alberta.

KOPPERS

BITUMASTIC
REG. U. S. PAT. OFF.
COATINGS AND ENAMELS

Kentucky River Crossing of 26" Texas Gas Transmission Co. line. Pipe and weights protected with Pitt Chem Plasticized Enamel.

Pipeline Reconditioning Here Could Cost A Fortune!

But Pitt Chem Enamel Assures Long-Term Protection and Low Maintenance Cost

THE extra cost of protecting your pipelines with coal tar enamels may look like pin money a few years from now. For the expense of excessive cathodic protection and reconditioning—which is often necessary when "economy" coatings are used—can sky-rocket your maintenance costs out of all economic proportion.

Coal tar enamels have *proved* their superior ability to resist soil stress and water absorption, the two principal reasons why other coating materials repeatedly fail. So why gamble? Specify *Pitt Chem* Coal Tar Enamels, just as scores of leading pipeline companies do each year, and be sure of minimum maintenance and long-lasting protection.

When you specify *Pitt Chem*, you enjoy the advantages of guaranteed quality, for *Pitt Chem* Enamels are manufactured under rigid production control—to *published* specifications. • How can we help you? Send us the details of your coating problem.

PITT CHEM® TAR BASE ENAMELS

• Standard Grade • Modified Grade
• Plasticized Grade • Hotline
• Cold Applied Tar Base Coatings

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COAL CHEMICALS • PROTECTIVE COATINGS • PLASTICIZERS • ACTIVATED CARBON • COKE • CEMENT • PIG IRON

7 Miles in 7 Days...

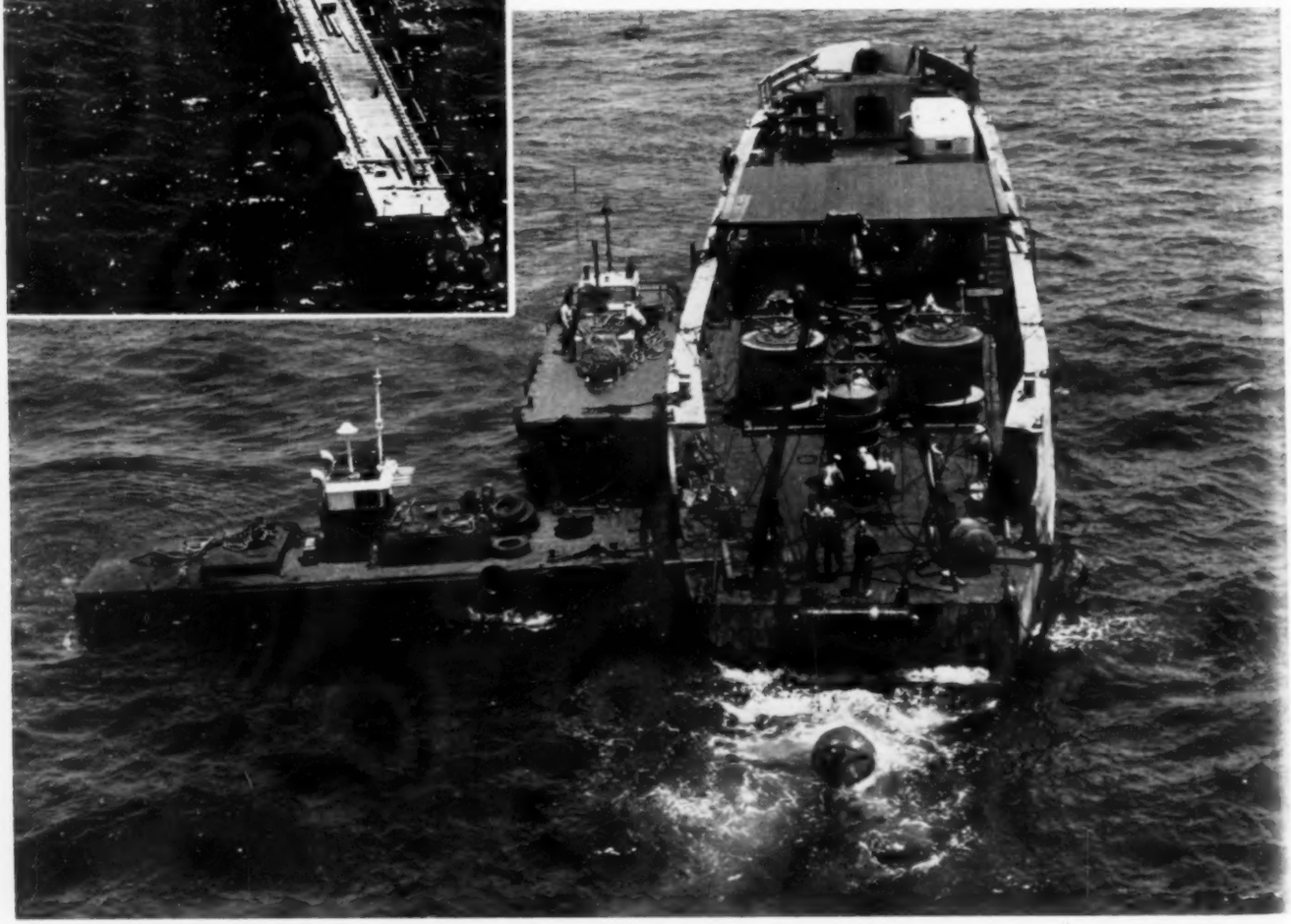
New techniques promise longer, deeper submarine pipelines

Collins' Friction-Transposition Method of installation was successfully introduced in one of the most publicized pipeline construction projects in history—Healy-Submarine-DeLong's 300-foot deep ocean outfall installation for Los Angeles' Hyperion sewage treatment plant at El Segundo. The overwhelming success of this project can be attributed to careful planning, a thorough analysis of the problems to be encountered, and to ingenuity and daring in the design and construction phases of the job. This installation might well serve as a pattern for other coastal cities seeking a means of sludge disposal; or for oil and gas transmission companies everywhere in the design or expansion of sea-loading systems.

COLLINS CONSTRUCTION CO.

Submarine Pipeline Specialists

P. O. Box 86 **PORT LAVACA, TEXAS**



PIPE LINE PANORAMA

Offshore Pipelining to Have Record Year . . . Four projects scheduled for Gulf of Mexico this year will extend submarine pipe lines by more than 100 miles:

1. Sharman, Allen, Gay and Taylor have completed 7-mile submarine stretch of Transco's 28.5-mile line south of Cameron area.
2. United Gas Pipe Line has completed southern Louisiana expansion, including 54 miles of 20-inch line from near Lake Charles to Deep Lake field, and about 9 miles of 8, 10 and 12-in. lines to reach other gas sources in Cameron Parish.
3. Marine Gathering's construction division is laying 25 miles of line for the CATC group off Grand Isle.
4. Brown and Root has three barges working on TGT's 68-mile submarine line to tap some two trillion cubic feet of offshore natural gas recently contracted by the company.

Watch Those High Annual Overhaul Costs . . . A leading contractor says to keep wary eye out for equipment that is running high in annual overhaul costs. Cost statistics show that machines which require high outlay during annual overhaul are costing more to keep up in the field during the job. There may be exceptions for special cases, but they will be obvious to the operator.

New Cathodic Protection Method for Offshore Lines . . . Forty years of maintenance-free cathodic protection is predicted for TGT's 21-mile, 26-in. submarine line off the Louisiana coast. Method: Built-in sacrificial zinc anodes (42—50 lbs. each) are buried as sleeve clamps on the pipe to protect center 10 miles of the line. Rectifier on the mainland and magnesium anodes on the platform will protect ends of the line. (See Page 28).

According to latest National Bureau of Standards estimate, corrosion costs U. S. pipe line industry $600 million per year through actual destruction, plus investments to prevent destruction.

"Boom Period" for Natural Gas Imports? . . . As of the end of August, Texas Eastern is importing the first significant quantity of gas to be brought to the U. S. from Mexico. Will ship it over 5900-mile long system to eastern markets. At first, the company will import about 115 million cubic feet per day. However, contract with Pemex calls for increase to 200 million cubic feet per day.

Also, two plans have been announced in recent weeks that would bring more natural gas from Canada to fast-growing population and industrial areas on the West Coast:

- Southern California and Southern Counties gas companies propose to buy an additional 200 million cubic feet per day from El Paso Natural, which would get its supply from Pacific Northwest with contracts for large quantities of Western Canada gas. If plan is approved, 700 miles of line will be built to move gas from point near Twin Falls, Idaho, to distribution facilities.
- Pacific Gas and Electric has announced plan to build 1300-mile line from Alberta gas fields to San Francisco. Cost: $330 million. Initial deliveries: 400 million cubic feet per day. Project is awaiting approval of FPC, California's PUC, Alberta and Canadian government agencies.

Needed: Higher Earnings Rates . . . Several gas transmission companies have asked FPC to raise ceiling on earnings rates. Possibly as high as 6.8 percent. Reason: Trend toward higher interest rates on gas industry bonds. Some are now averaging above 6 percent.

Special Maintenance Report

Individual zinc anodes and steel bands before fabrication of anode rings. Core through anodes is welded to the steel bands before the bands are bolted to the pipe. Twenty such anodes make up one anode ring. The anodes were designed physically to be flush with the concrete weight coat. Since the line will be jetted into the ditch, it was imperative that there be no discontinuities on the surface.

'Built-In' Anodes Protect Submarine Line

Anode clamps bolted to pipe and buried while laying the line to protect center ten miles of 21-mile line without future maintenance.

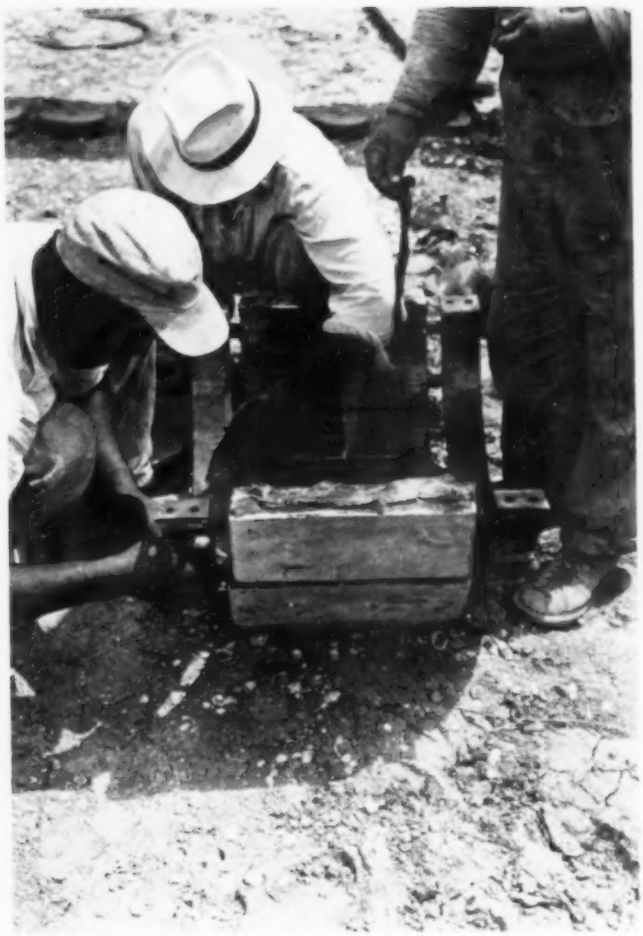
By A. L. STEGNER
Tennessee Gas Transmission Company, Houston
J. B. BAXTER
Tennessee Gas Transmission Company, Kinder, La.

How do you obtain complete cathodic protection of a long submarine line? This is a problem that Tennessee Gas Transmission Company is facing in the construction of a 21-mile line off the Louisiana coast. Sacrificial zinc anodes are being buried as a sleeve clamp on the pipe in an attempt to provide protection to the center ten miles of the line. A rectifier on the mainland, and magnesium on the platform will furnish protection for the two ends of the line.

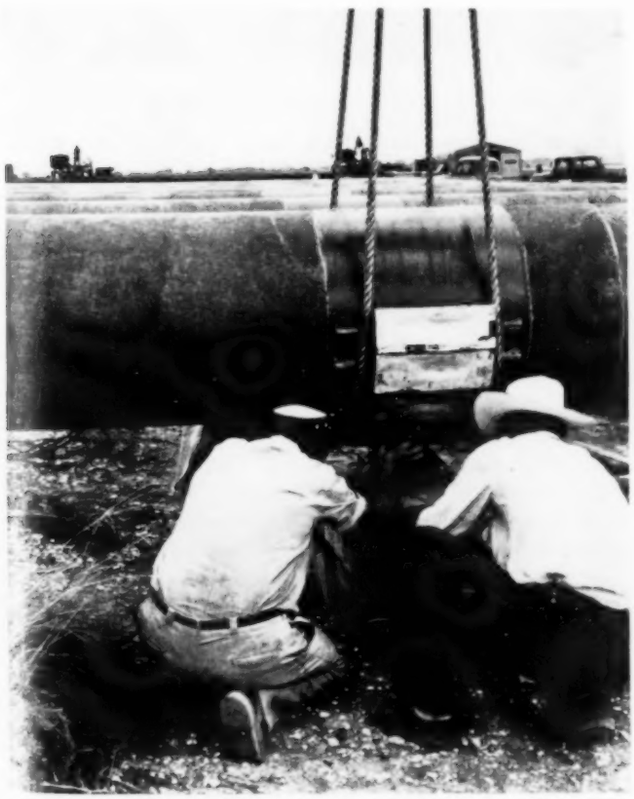
TGT is now laying this 21-mile, 26-inch line from an offshore platform in Block 49, East Cameron area, to the mainland near Cameron, La. It is a part of the gathering system which will serve the CATG group leases in the East Cameron area. About 60 miles of this gathering system will be under water, however this is the longest submarine span.

Bob Ransom and Marion Fran[illegible] of TGT's corrosion engineering department assisted in developing the idea. Help in the design was receive[illegible]

Half an anode ring, showing how anodes are attached to steel bands. Two of these half rings were used for one joint of pipe. The undersides of the anodes were wrapped with tape.



Underside of a half ring showing tape coating on back. Insulating material was poured between the anodes to isolate each anode electrically except for the connections to the steel bands.

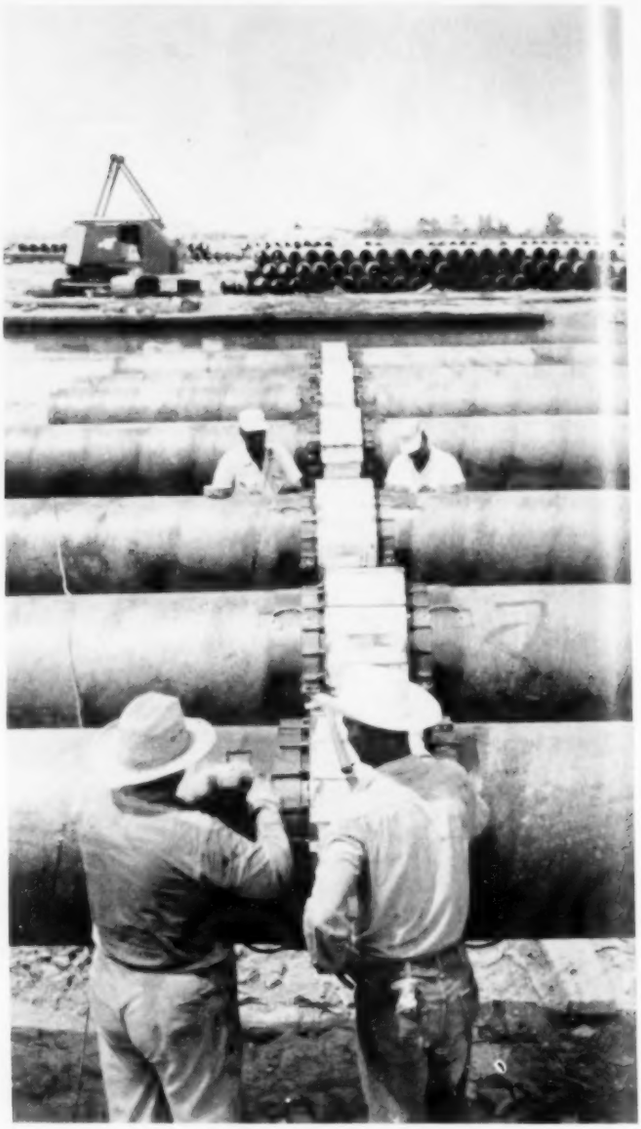


(Above) The only weld made on the pipe is the thermite weld for the anode to pipe connection. Two of these welds were made for each anode installation.

(Left) Lower half of ring being installed on pipe. Several thicknesses of plastic tape were wrapped around the pipe over the felt outer wrap.

Close-up of anode-to-pipe connection shows insulation around weld. Note arrangement used for bolting anode ring around pipe.

Joint in foreground has field jointer in place for patching concrete around anodes. Note reinforcing wire is cut back from anodes to prevent electrical contact between the wire and the anode. Joints in background have been completed and are ready for laying.



Rack of completed joints before concrete weight coating is applied. Anode rings are placed nearer one end of the pipe to prevent erratic motion of the pipe while the weight coating is applied. A joint of pipe with anodes will be laid every half mile.

from R. J. Baldwin, project engineer, who furnished data on the composition of the soil in which the line will be buried. A check of the resistivity of the soil through cores taken of the bottom showed it to be approximately the same as sea water. Installation of the anodes and concrete weight coating was made by Rosson-Richards at their Delcambre, La., plant.

Designed for 1% Coating Holidays. The line will be doped and wrapped in the conventional manner, and an outer coat of concrete will be applied as is general practice for submarine lines. In designing the installation, allowance was made for 1 percent holidays in the coating. Although this is a very high allowance, it was preferred to over design.

Designed For 40-Year Life. To obtain the projected life of 40 years, calculations indicated 21,000 pounds of zinc would be required. To meet the physical requirements for the installation, 420-50 pound anodes were used. Each anode installation consists of 20 anodes bolted around the circumference of the pipe. This arrangement made the weight of the anodes approximately the same as the concrete it displaced, preventing any unbalance of the load on the pipe. To prevent erratic spinning of the pipe while the concrete coating was applied, the anodes were located 10 feet from one end of a 40-foot joint. A joint containing an anode installation will be installed every half mile.

Physical Design of Anodes Critical. Individual anode dimensions were designed to allow 50 pounds of metal per anode and give a thickness which would be almost flush with the concrete coating. No discontinuity could be allowed along the pipe surface since the line will be jetted into the ditch. Special molds were prepared to give anodes that are 8 inches wide, 3½ inches thick and 14 inches long. Concrete thickness is 3⅜ inches.

Brackets for the anodes consisted of four semicircular steel bands. Two bands were bolted together to en

After concrete coating is applied, resistance between anodes and steel reinforcing is checked to be sure there is no short. In some cases the concrete had to be chipped out and the wire cut back further. Any resistance under 6 ohms was considered a direct short.

Stegner Baxter

About the Authors

A. L. STEGNER received his B.E.E. degree from Louisiana State University in 1928. He was engaged in power transmission and distribution engineering from that time until he entered the service in 1941. Since 1946 he has been with Tennessee Gas Transmission Company directing the corrosion control program and the Radio Communications department. He is a registered professional engineer of the State of Texas. He has served on the NACE board of directors and at the present time is treasurer of the organization. He is a member of the AIEE, PIEA, serves on corrosion committees of API and the Natural Gasoline Association.

J. H. BAXTER is field corrosion technician for Tennessee Gas Transmission Company in the south Louisiana area. He is in charge of all cathodic protection surveys and maintenance in the marshlands and offshore. Before joining TGT's corrosion section Baxter was in that company's communication division.

compass the circumference of the pipe. The steel cores on which the anodes were cast were welded to these steel bands. All welding was done before the bands were bolted to the pipe to avoid setting up heat stresses in the pipe and destruction of the coating. Only after the anodes were in place, was a thermite weld made to connect the steel bands to the pipe.

Anodes Isolated Electrically. Several thicknesses of plastic tape were wrapped over the felt outer wrap under the anode bracket as insurance against mechanical damage of the coating, and to provide additional electrical resistance between the pipe and the anodes. Further insulation of the anode ring was obtained by wrapping the underside of the anodes with tape. Insulating material was poured between the individual anodes making the only connection between anodes through the anode core to the steel band.

Special care was exercised to prevent any electrical contact between the steel reinforcing in the concrete and the zinc anodes. After completion of the coating, the resistance was checked to be sure there was no short between the two.

Insurance Against Coating Damage. If the sacrificial anodes perform as planned, less current will have to be furnished by the installation at each end of the line. It is expected that the maximum cathodic voltage will be under —1.1 volts measured to a copper sulfate electrode. Keeping the voltage low will prevent possible damage to the protective coating. Although no serious stripping of the coating during the laying operation is anticipated, if this does occur, the zinc anodes should provide protection for these holidays.

No measurements are planned to determine the output of the zinc anodes. It is anticipated that if the coating is still substantially intact after the laying operation is completed, a shift of voltage will be apparent at the ends of the line. A check for this shift should give an indication of the coating condition.

—The End

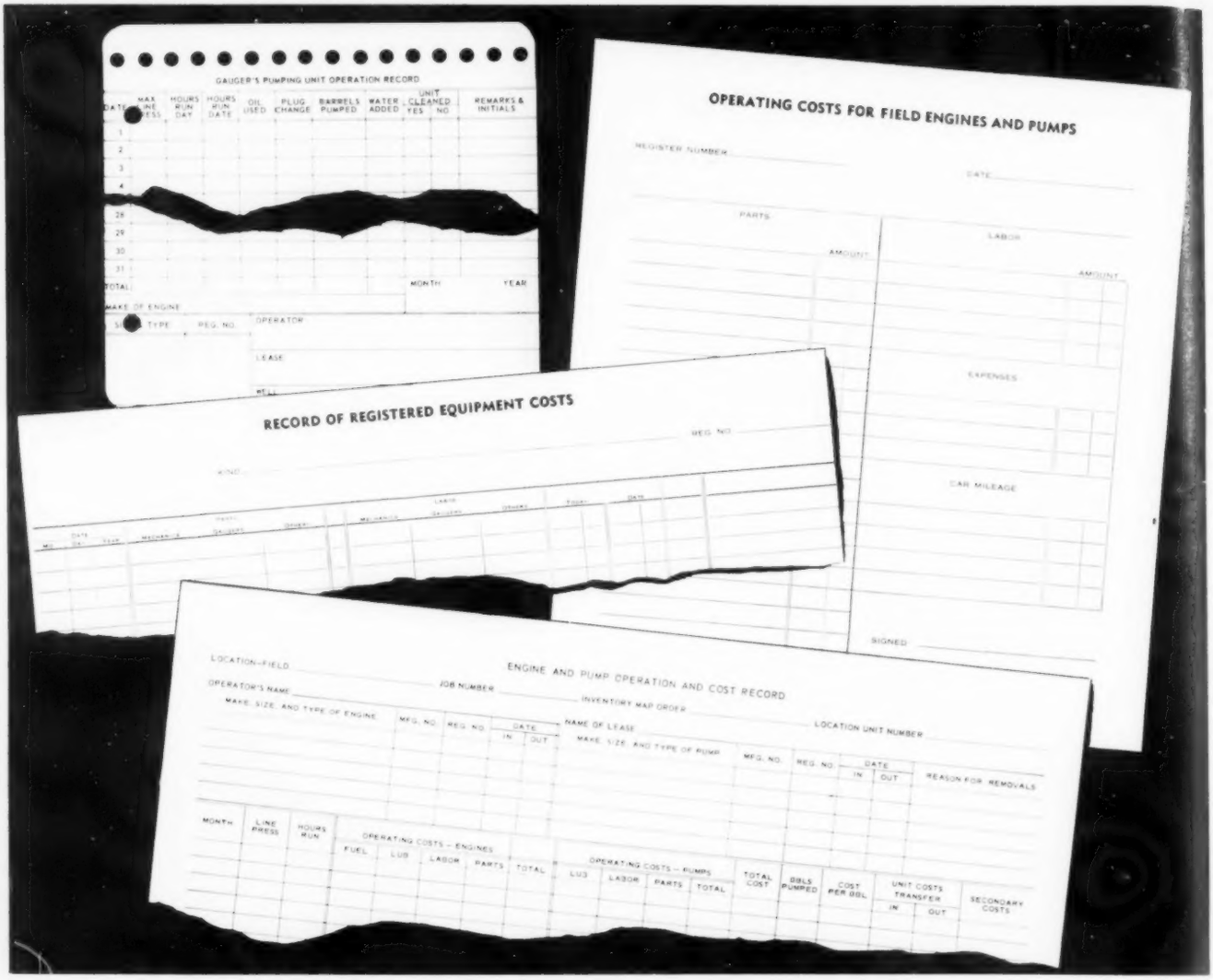

GAUGER'S PUMPING UNIT OPERATION RECORD
OPERATING COSTS FOR FIELD ENGINES AND PUMPS
RECORD OF REGISTERED EQUIPMENT COSTS
ENGINE AND PUMP OPERATION AND COST RECORD

FIGURE 1—Examples of forms used to keep operating records and repair costs for field pumping units.

Complete Maintenance Records Pay

This survey of leading oil and gas pipe line companies shows clearly how they save money by having complete maintenance costs available for study.

By JOHN C. WATTS
Engineering Editor

EXPERIENCE MAY be the best teacher, but in order to learn the lesson, a record of past experiences must be available. Many far sighted pipe line companies take advantage of past experience through maintenance records. These records can be used to:

- Locate "hot spots" where operating costs are excessive.
- Present better operating studies.
- Compare different types of equipment.
- Determine the most economical operating range for any given type unit.
- Help in compiling the budget.
- Maintain good communications between the various departments.

Although operating cost records are usually kept by the accounting department, unless the information is kept

on automatic accounting machines, the information is usually not in a form that is useful for maintenance and engineering groups.

Where automatic machines are used, information needed can be accumulated on short notice and no further records are needed. But, when this type accounting record is not available, it is advisable for the maintenance or engineering departments to devise their own method of keeping up with costs. Maintenance records which contain the proper information not only allow the engineering department to follow the operation of equipment, but enable field maintenance men to keep a better check on their own maintenance program.

When accounting records are depended upon for maintenance costs, these records are summarized at least once a year. An annual report containing a summary of the cost data places such information in the hands of those concerned, in a form which they can analyze for the desired information.

Record Format Varies. Maintenance records will vary according to the type equipment covered and the location of the unit, as well as the individual company's policies. Make-up can vary from elaborate manuals to informal letters or reports describing an actual repair job. A series of forms is the simplest method of tabulating the information. Less time is required in preparation and the information is in a more usable form.

Regardless of the format, in order to be most effective, reports should include the following information:

- Complete description of unit.
- Location of unit.
- Operating conditions.
- Complete description of work done.
- Cause of failure.
- General condition of unit.
- Repair costs.
- Operating costs.

Location Justifies Extra Attention. It is important to include the location of the unit, because in many cases a unit is penalized because of additional cost due to its remote location. However, the remote location makes it possible to justify overdesign and preventive maintenance procedures which would not be practical in a more convenient location.

Operating Record Gives Valuable Information. Information as to the over-all condition of the unit is useful in determining future maintenance problems. Studying this portion of the report helps to predict possible future repairs or replacement for inclusion in the budget. Also the cause of failure is important in preventing a recurrence of the same failure.

Operating costs are important in determining the efficiency of the unit. Even though the unit seems to be operating satisfactorily, many times savings in operating costs can be obtained by repairs which will return the unit to peak efficiency.

Studying the operating record enables the engineers to determine the suitability of the equipment for the particular location. Also in making purchases of new equipment, studying the operating costs of this type equipment already in use aids in selecting units which have given the best service.

Examples Cover Information Needed. As with the content, the form used for maintenance records will depend on the individual situation. Types of records which are used include:

- Costs of individual jobs.
- Summaries of costs for one unit or location.
- Inspection reports.
- Check sheets.

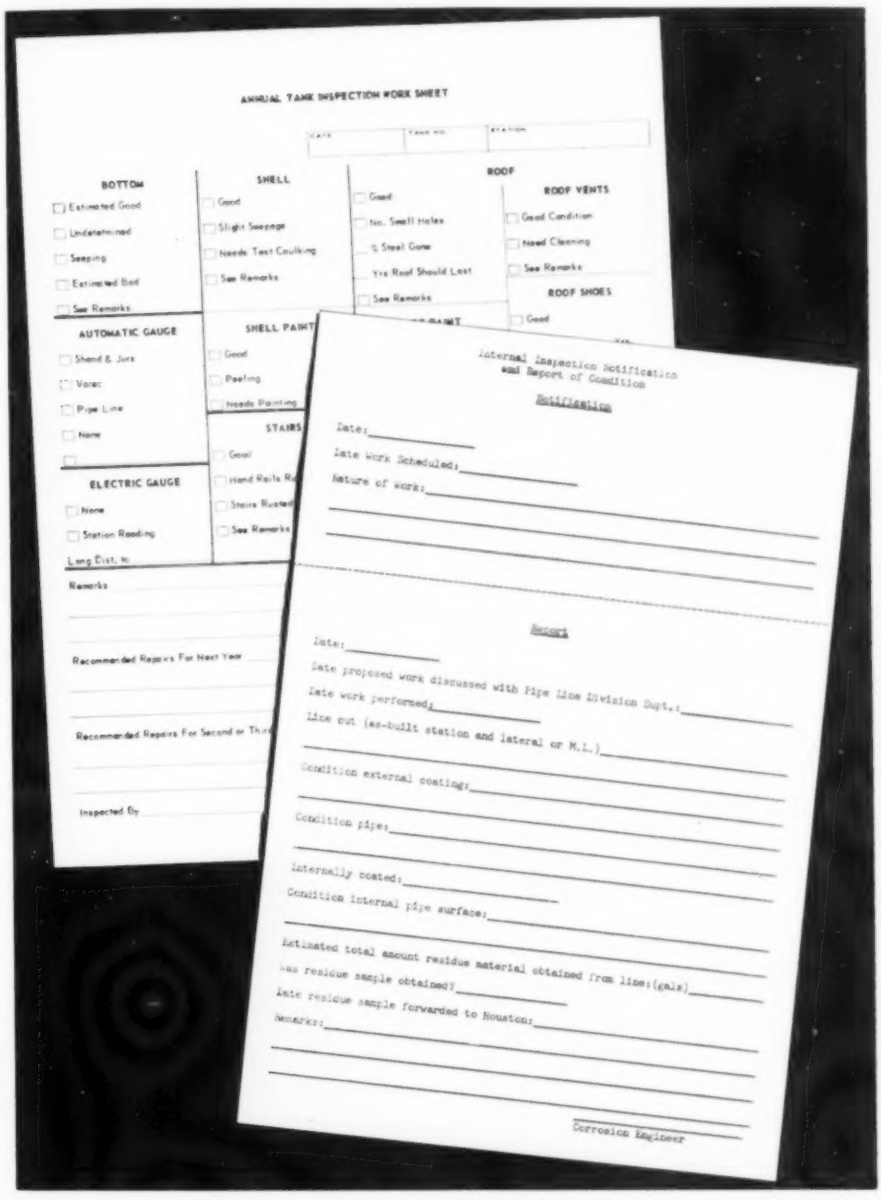


FIGURE 2—Examples of inspection reports and check sheets.

FIGURE 3—Chart showing continuous operating conditions of diesel engine.

- Charts or tabulations showing continuous operating conditions of unit.
- Alignment type charts to show condition of pipe.
- Oil loss and leak repair reports.

In many cases, a number of these items are covered on one report form. For example, the tabulation of continuous operating conditions and cost of repairs for the same unit could be combined. A chart of this type, "Gauger's Pumping Unit Operation Record," is shown in Figure 1. The remainder of the forms included in Figure 1 give examples of the various forms that are used to report costs and operation of an individual field pumping unit.

Inspection Reports Aid in Planning. Inspection reports are especially helpful when making periodic repairs and in carrying out preventive maintenance programs. If a thorough inspection is made when a unit is off the line and a report of this inspection is made, the scheduling of future repairs is easier. Also information in this report may eliminate future emergency shutdowns.

Two such examples of inspection reports are included in Figure 2. One is designed for an annual inspection; the other for use on more an emergency basis. Completion of the "Annual Inspection Work Sheet" will enable adequate planning for the maintenance program. It will also point out possible future troubles which may be cheaper to remedy before failure occurs.

Report Shows Pipe Condition. Use of the "Internal Inspection Notification and Report of Condition" form provides a check on the condition of the exterior and interior of buried lines. Any time the pipe is to be disturbed, whether for repairs or for new construction, the top half of the report is filled out and sent to the proper office. Upon notification a corrosion engineer will be present when the line is opened and fill out the report of the pipe condition. A compilation of these reports taken at random points on the line will give an accurate description of the condition of the pipe.

Tables or Charts Give Operating Data. Continuous operating records are valuable tools in preventive maintenance programs as well as an aid in making emergency repairs. These reports can be either in tabular form as in the "Gauger's Pumping Unit Operation Record," or in chart form. Figure 3 is an example of the use of the chart form for diesel engine maintenance. A complete description of the use of these charts has been published previously (PIPE LINE INDUSTRY, September, 1955, Page 40). These graphs will give a complete picture of the condition of the engine. Generally any troubles can be pin-pointed by the information included. The use of charts such as these will not only lessen the danger of emergency repairs, but will make it possible to discontinue shutdowns for inspection purposes.

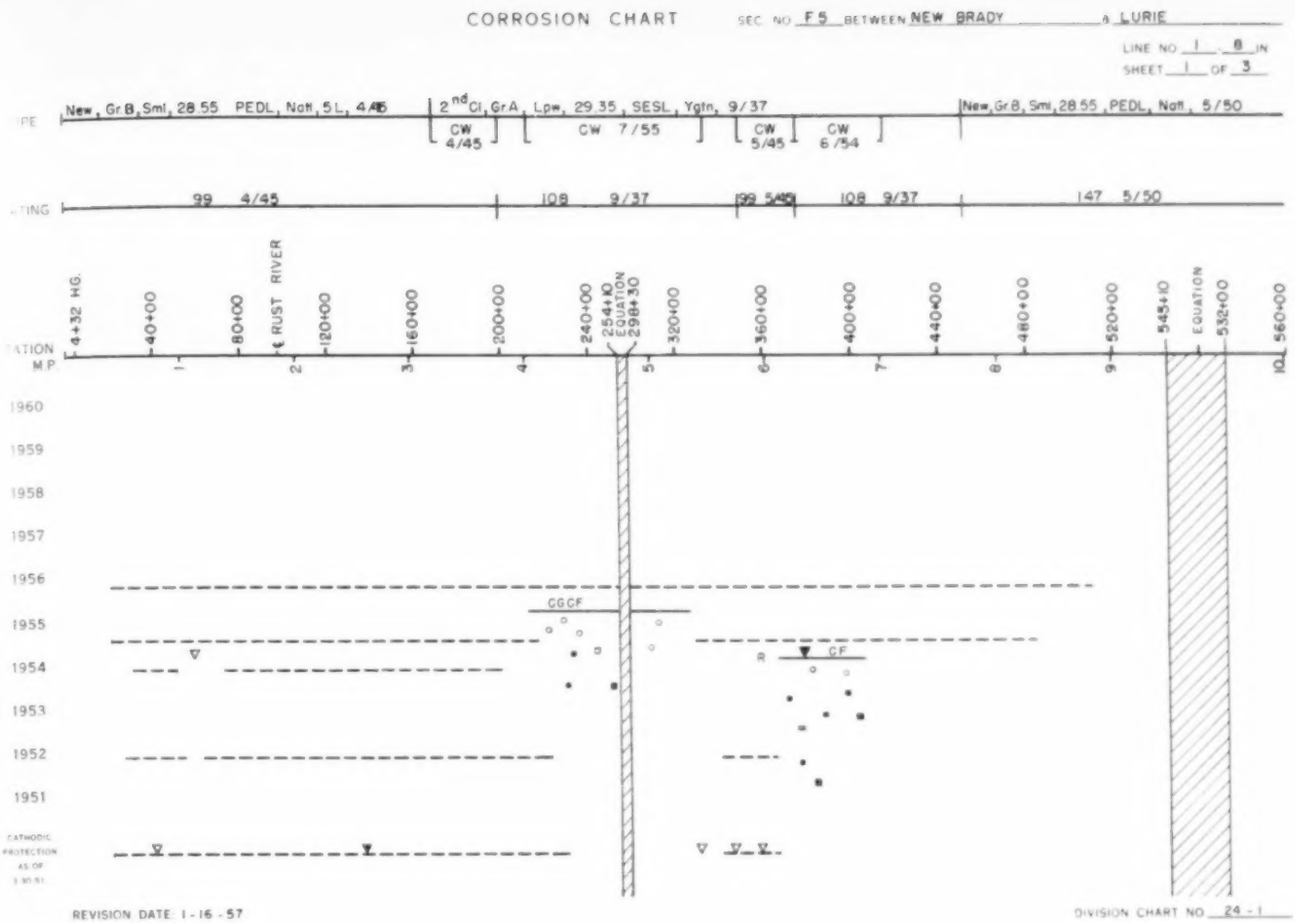
Corrosion Chart Gives Data. Corrosion cost records are usually one of the more important maintenance records. For this reason, in many cases numerous forms are required to record the information. Figure 4 is a corrosion chart which combines most of the corrosion information that is needed with an alignment chart. A glance will give much of the information that is needed about a certain section of the line. As well as containing corrosion information, mechanical failures are also included. Additional information such as river crossings, road casings, etc. is also available. Through the use of symbols most construction data is summarized, also.

Maintenance Records a Must. Good maintenance records are a pre-

Watts Named Engineering Editor

This thorough staff report introduces to PIPE LINE INDUSTRY readers our most recent staff addition. John C. Watts has a wealth of experience in pipe line engineering and operations.

Following graduation with a B.S. in chemical engineering from Mississippi State College, he did graduate work at the University of Alabama. Watts completed various engineering assignments with Humble Pipe Line Company, serving as corrosion engineer of the company's West Texas Division from 1952 to 1955. Prior to joining the PIPE LINE INDUSTRY staff, he was technical representative for Internal Pipeline Maintenance Company of Odessa, Texas, for two years. An active member of the National Association of Corrosion Engineers, Watts has served as chairman of its pipe line Technical Committee T-2F and in several local section offices. He is also a charter member of the Houston Pipeliners Club.



Symbols Used in Corrosion Chart

PIPE

Cl.	Class	Natl.	National Tube
Gr.	Grade	J & L	Jones & Laughlin
		A O S	A. O. Smith
Lpw.	Lapweld	Ygtn.	Youngstown Steel
Sml.	Seamless	Beth.	Bethlehem Steel
Elw.	Electric Weld	Repb.	Republic Steel
		Cons.	Consolidated Western Steel
PE	Plain End	Spng.	Spang-Chalfant Steel
SE	Screw End	Wheel	Wheeling Steel
SL	Single Length Joints (20')		
DL	Double Length Joints (40')	5 L	A.P.I. Line Pipe Specifications
		5 LX	A.P.I. High Test Pipe Specifications
CW	All collars welded		

COATINGS

CF	Coal tar enamel and asbestos felt wrap
CG	Coal tar enamel and glass wrap
CGCF	Coal tar enamel reinforced with glass and wrapped with asbestos felt
CGCFW	Coal tar enamel reinforced with glass and wrapped with asbestos felt, and weighted with concrete
AF	Asphalt enamel and asbestos felt wrap
AG	Asphalt enamel and glass wrap
AGAF	Asphalt enamel reinforced with glass and wrapped with asbestos felt
AGAFW	Asphalt enamel reinforced with glass and wrapped with asbestos felt and weighted with concrete
AM	Asphalt mastic
SF	Cold applied solution wrapped with asbestos felt
SG	Cold applied solution wrapped with glass
PT	Plastic tape

LEAKS, REPAIRS, AND CATHODIC PROTECTION
(See specimen chart for proper size and weight of symbols.)

O	External Corrosion Pit Leak—Temporary repair.
●	External Corrosion Pit Leak—Permanent repair. (Fill in original open symbol of temporary repair.)
Ø	Internal Corrosion Pit Leak—Temporary repair.
ø	Internal Corrosion Pit Leak—Permanent repair. (Fill in original open symbol of temporary repair.)
□	Collar Leak, clamped.
■	Collar Leak, welded. (Fill in original open symbol of temporary repair.)
‖	Line Break
=	Line Split
×	Other failures
CF	Length Reconditioned, showing coating applied.
▽	Galvanic Anode Installation. Apex of inverted triangle at time and location of the installation.
▼	Rectifier and Ground Bed Installation. Apex at time and location of installation.
- - -	Extent of Cathodic Protection (min. -0.85-P/S), when it exceeds 200', as measured in P/S surveys.
R	Anode or Rectifier Installation removed or depleted and not replaced. At time and location coordinates of removal or depletion.

FIGURE 4—Corrosion chart combines corrosion data with alignment and construction information.

requisite of a satisfactory preventative maintenance program. Many of the records needed are already available if complete cost records are kept. Substantial savings can be realized by making full use of maintenance cost records in conjunction with a good preventive maintenance program.

—The End

Special Maintenance Report

Here is one approach to the problem of finding out how long a piece of equipment can be kept in service economically . . . it provides some answers to the question . . .

When to Replace Construction Equipment on a Spread?

By FRED L. BAUMANN
Caterpillar Tractor Company
Peoria, Ill.

WHEN SHOULD an old construction machine be replaced? How can it be determined that it is more economical to replace present equipment with a new machine, particularly when the present machinery appears to be operating satisfactorily?

These are questions posed quite frequently in the minds of pipe line contractors. And the replies appear to have been as numerous as the people seeking answers.

Several methods are now in use in the field to determine this economical time to replace. One owner points out that when a tractor reached an age of three years it became a headache. He didn't like headaches, so he replaced his tractor every three years. Some companies replace their equipment just before a major overhaul is needed. Another method is to replace older machines whenever there seems to be some extra money in the treasury.

Point of Lowest Operating Cost. The METRE (most economical time to replace equipment) method has been developed to aid the equipment owner in determining the point of lowest possible hourly operating costs. By use of the method, this important dividing point between decreasing and increasing operating costs can be removed from the realm of intuition, and be found on a dollar and cents basis. Its accuracy, of course, is dependent upon the specific data the owner can supply from his own records. Initially worked out for crawler tractors, it can be applied to almost all types of equipment.

While not attempting to forecast operating costs, this method utilizes the owning and operating costs of individual machines to determine most economical replacement time.

Costs cited here should not be considered typical or average; they were chosen arbitrarily and differ widely depending on the type of machine evaluated and the severity of the conditions under which it operates. Emphasis should be placed on the keeping of as accurate and complete cost and performance records as practicable since they are the only basis on which the METRE method may be validly used.

Before getting into the mathematics of economical replacement, it is important to review some of the factors to be considered. Major repair and overhaul costs are the first and most evident factors. Of equal importance, though not so apparent, are the costs of productivity, unavailability and capital decline.

Repair Costs Increase With Age. As a pipelayer or any other piece of equipment gets older, the repair costs get higher. For example, the engine would require only rings, liners and a valve job on the first overhaul, but on the second it might require a new crankshaft, bearings and pistons, plus the same items as on the first. A similar pattern would apply to the cable control, master clutch, steering clutches and other components serviced as a whole.

Productivity Should Be Considered. One of the most difficult factors to measure in pipelaying machinery is productivity. Improvements are constantly being made on tractors and pipelayers, which add varying amounts of productivity, depending on individual machine applications. A new tractor, because of its higher horsepower, faster working speeds, improved attachments, increased operator comfort, etc., will produce more work than an old tractor on such operations as ripping and right-of-way clearance. However, in pulling welding machines or winching a coating machine, a new tractor's productivity will not ordinarily be used, since an old machine could perform the job adequately. Therefore, a sliding scale of productivity must be used, with each individual machine application being evaluated separately.

While increase in horsepower is no

ctly proportional to an increase in duction, other improvements such more clearance, hydraulically sted controls, better visibility, bet- stability, and greater lifting capac- tend to make the productive abil- of a tractor or pipelayer increase approximately the same rate as the sepower, in most applications. hen an old tractor is used, it should charged for any production that y be lost through its use. For ex- ple, if a new tractor will produce percent more than a five-year-old ctor on certain jobs, the old trac- or should be charged for its inability produce as much.

Old Equipment's Productivity Less. In the few applications where n increase in production of the trac- or cannot be utilized, the productiv- ty cost would not be valid. For ex- ample, if an old tractor equipped with a 'dozer were being used to backfill, and were able to keep pace with the laying crew, the additional produc- tion of a new tractor could not be utilized. On the other hand, if the old tractor could not keep up with laying operations, the new tractor's greater productivity would be used. Cost per mile of trench backfilled would also be lower, since there would be no need to employ a second ma- chine to make up for the old tractor's inability to do the complete job. In this instance, the old tractor should be charged for this inability.

In determining a dollars-and-cents charge for an old machine's produc- tivity, experience and job conditions often dictate the monetary value of the lost production. A fair, but con- servative method would be to charge the machine with the cost of renting a tractor to make up the difference be- tween the old machine's production and that of a new tractor.

Availability An Important Factor. Machines should also be judged on he basis of availability, or the number f hours the machine is down in com- arison to the number of hours it ould have worked. Down time should nclude any delay for adjustments, re- pairs, greasing and so forth, but should not include major overhauls (listed under separate section).

Due to greasing, fueling, cable re- placement and minor adjustments, a ew tractor or pipelayer is not 100 ercent available. New machinery will sually be available for work about 96 percent of the time under average conditions. For more extreme condi- tions this figure would be lower. Once again, familiarity with the individual machines and applications would dic- tate a new machine's exact percentage of availability; obviously, requiring the keeping of accurate and complete machine records.

When charging a tractor for not being available, it should be charged with the cost of renting an additional machine to do the work the tractor could have done had it had the avail- ability of a new tractor. For example, if an older machine is available only 80 percent of the time on a particular job it should be charged with the rental of a machine to perform the additional 16 percent working time, to bring its availability up to 96 per- cent, or that of a new tractor. If a pipelayer were being used to lower in, and the progress of the line were held up because the pipelayer was down, the cost could be even greater.

Depreciation Effects Cost Figures. Obviously, most equipment owners do not trade in their equipment every season or every half season because the difference between the original cost and the trade-in value would cause prohibitive operating costs. Dif- ferences between the original cost and the trade-in value is called "capital decline." The cost of capital decline should be charged to the tractor in the year in which the decline occurs, not averaged throughout the life of the machine.

METRE Method Depends on Cost Records. To more fully understand the mechanics of the METRE method, the following example has been outlined, using arbitrary, what can be considered typical machine fig- ures. The tractor and conditions were chosen for the purpose of illustration only. When using the METRE method to compute the economical time to replace equipment on a spe- cific job, data similar to that given in Chart 1 should be gathered from the particular job on which the tractor is working.

CHART 1
TRACTOR X

Original Cost (equipped with Dozer and Control)	$20,000
Rental Value	$10/hour
Conditions	Average
Horsepower	100
Cost of Labor and Parts for Overhauls	Listed on Page "Cost of Major Repairs & Overhauls"
Life Between Overhauls:	
Engine	6,000 hours
Steering Clutch	5,000 "
Brakes	500 "
Tracks	3,000 "
Cable Control	3,000 "
Roller Frame & Sprocket Group	5,000 "
Master Clutch (oil type)	10,000 "
End Bits and Cutting Edges	1,000 "
Transmissions & Final Drives	6,000 "
Guards, Hoods and Fenders	3,000 "
Hours Operated:	
First, Second and Third Years Each	1,800 "
Each Year Thereafter	1,500 "

STEP 1—Determining Hourly Cost of Major Repairs and Overhauls. Chart 2 contains the data necessary for determining the hourly cost of major overhauls and repairs. Most im- portant among these figures are those showing total cost of each repair or overhaul, and hours between these operations.

Cost per hour for all repairs is ar- rived at by dividing the cost of repairs by the number of hours the engine operates before subsequent repairs are made.

In determining the hourly costs for major repairs and overhaul, the costs should be projected over the expected li.e of the overhaul. Costs should not be charged until the overhaul occurs, because the original part was paid for in the price of the machine.

For example, the first engine over-

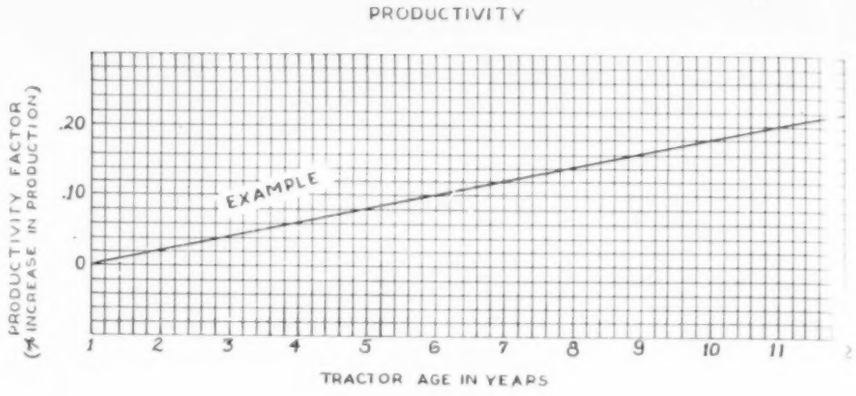
About the Author

FRED L. BAUMANN, head of the pipelayer section of Caterpillar Tractor Company's Development Division, is a 1949 science graduate of Cornell University. In his eight years with Caterpillar he has had wide experience in graduate training program, earthmoving equipment division, and development and application of pipe line construction machinery. He served with the Air Force from 1943 to 1946 as a first Lieutenant.

haul was performed in the illustration at the end of 6000 hours of operation. Since the 6000 hour point occurs in the fourth year of machine life, the hourly cost for engine overhaul during the first three years is zero. The first overhaul lasts 6000 hours, until the eighth year of operation. Therefore, the cost of the first overhaul should be charged against the machine for the 6000 hours it worked during the fourth, fifth, sixth and seventh years of operation. The same is true for overhauls and major repairs on all components.

The only costs for overhaul and major repairs which should be charged to the machine during the first year are for brakes, and end bits and cutting edges. Repairs to the brakes were made at 500 hours, and to end bits and cutting edges at 1000 hours, both of which, as you will note, occur in the machine's first year of operation. Therefore, the charge for their repair is assessed to the machine during its first year.

STEP 2—Determining Hourly Charge for Old Machine's Diminishing Productivity. Chart 3 contains exemplary data for determining the amount of productivity to charge against an aging machine. The graph contains a curve depicting an increase in new machine productivity equal to 20 percent in 10 years. This, of course, would be modified by the type of application on which the machine is used, as explained previously.



A new tractor is more productive on most jobs than an old tractor because of greater horsepower, clearance, visibility, etc. The old tractor should be charged with the cost of renting additional equipment to make up the difference in production where necessary. The cost of productivity would be 0 the first year since another new tractor could not produce more.

CHART 3

A	B	C	D
YEAR	(Read From Graph) Productivity Factor	Rental Cost Hour (Tractor & Dependent Equipment)	Cost Hour (Column B x Column C)
1	0%	.....	0
2	2%	$10.00	.20
3	4%	10.00	.40
4	6%	10.00	.60
5	8%	10.00	.80
6	10%	10.00	1.00
7	12%	10.00	1.20
8	14%	10.00	1.40
9	16%	10.00	1.60
10	18%	10.00	1.80

CHART 2

Cost of Major Repairs & Overhauls

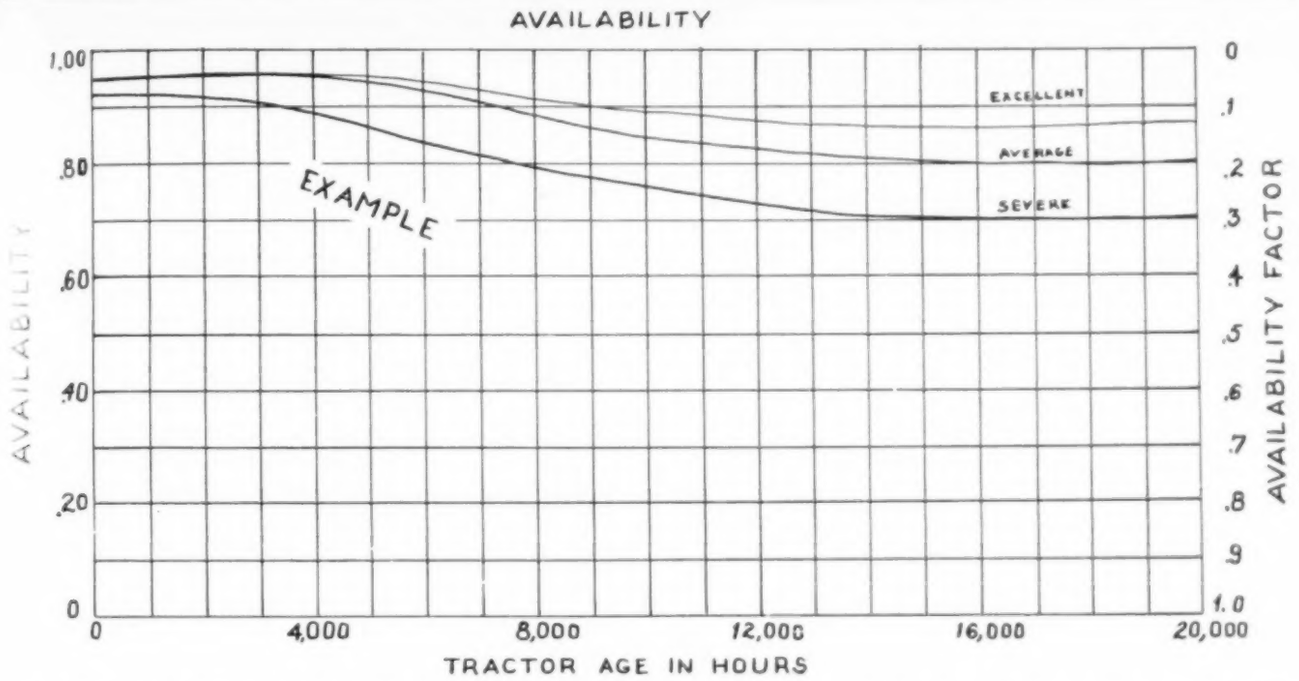
The cost of a major repair or overhaul should be projected over the expected life of the overhaul. The cost should not be charged until the overhaul occurs because the original part was paid for in the price of the machine.

COMPONENT	Overhaul	Parts Cost	Hours of Labor	Cost of Labor @ $2.50	Total Cost of Repairs	Hours Between Overhaul	Cost Per Hour
Engine	1st	$ 488	104	$260	$ 748	6,000	.12
	2nd	1,050	126	315	1,365	6,000	.23
	3rd	1,520	112	300	1,820	6,000	.30
Steering Clutch	Each	390	20	50	440	5,000	.09
Brakes	Each	17	7	17.50	34.50	500	.07
Tracks	New Set	1,835	5.2	13	1,848	3,000	.62
Cable Control	1st	71	8	20	91	3,000	.03
	2nd	178	14	35	213	3,000	.07
	3rd	147	14	35	182	3,000	.06
Roller Frame & Sprocket Group	1st	1,782	44	110	1,892	5,000	.38
	2nd	2,315	57.4	143	2,458	5,000	.49
	3rd	2,610	64.5	161	2,771	5,000	.55
Oil Type Master Clutch	Each	553	19.2	48	601	10,000	.06
End Bits & Cut. Edges	Each	67	6	15	82	1,000	.08
Transmission & Final Drives	1st	756	42	105	861	6,000	.14
	2nd	1,603	55.4	138	1,741	6,000	.29
Guards, Hoods, Fenders	1st	255	2	5	260	3,000	.09
	2nd	529	6	15	544	3,000	.18

As shown on the graph, the cost of productivity would be zero the first year, since another new tractor could not produce more. However, as the tractor ages, its productivity becomes progressively less than that of a new tractor. The curve shows this lag to be in increments of 2 percent per year. That is, each year a machine ages, a new tractor will outproduce it by an additional 2 percent.

In order to determine the amount to charge against the old machine, multiply the productivity factor by the hourly rental cost (in this case $10) for a machine to make up the difference in productivity.

STEP 3—Determining Hourly Cost for Old Machine's Diminishing Availability. Chart 4 contains an example of how availability is com-



A new tractor is available to do work a greater percentage of the time than an old tractor. The old tractor should be charged with the cost of renting additional equipment to make up the difference in the availability of the old tractor when compared with a new tractor. The above curve was plotted from data from several contractors' records.

puted. A new tractor is available to do work a greater percent of the time than an old tractor. Therefore, the old tractor should be charged with the cost of renting additional equipment to make up the difference in the availability of the old tractor when compared with a new tractor.

Three curves have been plotted on the graph, depicting descending percentages of availability for an aging machine, under excellent, average, and severe conditions. For the purpose of the illustration, the curve depicting average conditions has been used.

Since a new machine is available only 96 percent of the time, the availability factor for the first year (1800 hours) of operation is .04, or equal to the percentage of time it is not available. At the two year mark (3600 hours) the machine is available only 95 percent of the time, and the availability factor is .05.

As the machine becomes older, its availability becomes less and its availability factor becomes larger, until its ninth year.

During the ninth and tenth year, the machine's availability levels at 80 percent, and its availability factor stabilizes at .20.

To determine the hourly charge against the old machine's lack of availability, the availability factor is multiplied by the hourly rental charge of equipment necessary to make up the difference in availability.

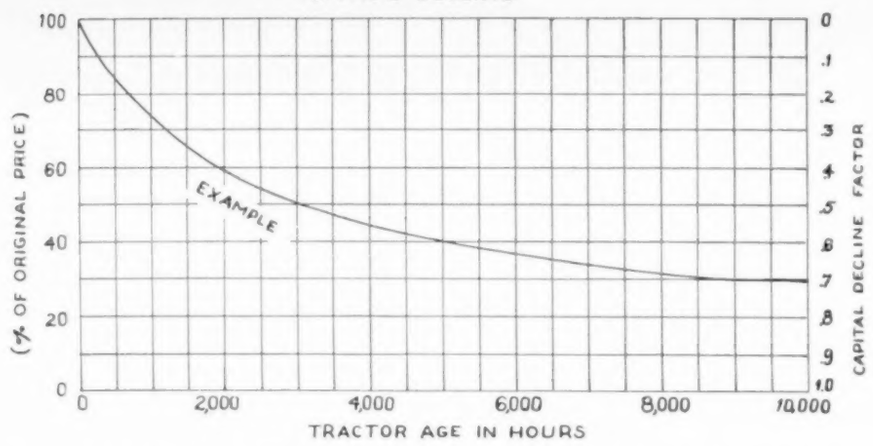
CHART 4

A	B	C	D	E
YEAR	Hours on Machine At End of Year	Availability Factor (Read From Right Side of Graph)	Rental Cost Hour (Tractor & Dependent Equipment)	Cost per Hour (Column C x Column D)
1	1800	.04	$10.00	.40
2	3600	.05	10.00	.50
3	5400	.07	10.00	.70
4	6900	.11	10.00	1.10
5	8400	.14	10.00	1.40
6	9900	.17	10.00	1.70
7	11400	.18	10.00	1.80
8	12900	.19	10.00	1.90
9	14400	.20	10.00	2.00
10	15900	.20	10.00	2.00

STEP 4—Determining Hourly Charge for Capital Decline. Chart 5 contains a graph plotted with a curve showing capital decline occuring during the machine's productive life. The curve shown was plotted from the sale of 2000 used tractors of all makes, models, and ages. However, since capital decline is highly sensitive to local conditions, it should be restated that the data shown is for illustrative purposes only, and should not be used when computing capital decline for a specific machine. Machine owners should plot their own capital decline curves, based on their own records.

The capital decline factor represents the percentage of decline in the machine's value from its original cost. For example, the capital decline factor for the first year of operation is .38, meaning that the machine has decreased in trade-in value 38 percent. Since the initial cost of the machine was $20,000, this factor equals $7,600 for the first year. The hourly capital decline is found by dividing the dollar value of capital decline by the number of hours operated.

For the second year, and all subsequent years, the annual capital decline is found by subtracting the total capital decline at the end of the previous year from the total capital de-



The capital decline is the difference between the original price and trade-in value. The annual capital decline should be divided by the number of hours used in that particular year to find the cost per hour for capital decline. The above curve was plotted from the sale of 2000 used machines of all makes, models and ages.

CHART 5

Year	A Hours Used Per Year	B Hours on Machine At End of Year	C Capital Decline Factor (Read From Graph)	D Total Capital Decline (Column C x Original Price)	E Total Capital Decline At End of Previous Year	F Annual Capital Decline (Column D — Column E)	G Hourly Cost (Column F ÷ Column A)
1	1800	1800	.38	$ 7,500	0	$7,600	4.22
2	1800	3600	.52	10,400	$ 7,500	2,800	1.55
3	1800	5400	.60	12,000	10,400	1,600	.89
4	1500	6900	.66	13,200	12,000	1,200	.80
5	1500	8400	.68	13,600	13,200	400	.27
6	1500	9900	.70	14,000	13,600	400	.27
7	1500	11400	.70	14,000	14,000	0	0
8	1500	12900	.70	14,000	14,000	0	0
9	1500	14400	.70	14,000	14,000	0	0
10	1500	15900	.70	14,000	14,000	0	0

STEP 5—Determining Most Economical Time to Replace Equipment. Chart 6 is a filled-in work sheet for determining the economic life of the machine.

Found on this work sheet are the hourly costs involved in owning and operating tractor X for ten years of its productive life.

On the last line, the average hourly cost was computed on the basis of what it would cost to use the tractor each hour if it was to be replaced at the end of the first year, or for each hour that it was worked during a two year period by averaging the first and second year, and so on through the ten year period. As shown here in the example, the lowest operating cost per hour would be obtained by using the machine for three years and then selling it.

It might appear that the $0.11 difference between the third and fourth year would be so slight that at the end of the third year with very little additional expense the tractor could be used for a fourth season. It must be understood, however, that if the tractor was originally set up to operate for three years, the charge per hour for the fourth year would then be $4.25 an hour. The actual difference in dollars between the third year operations and the operation for the fourth year would be $759.00 (6900 hours at 11 cents per hour).

cline up to the current year. For example, the total capital decline up to and including the sixth year is $14,000. At the end of the fifth year, the capital decline was $13,600, making the capital decline for the sixth year $400. The hourly capital decline for the sixth year was 27 cents, or $400 divided by the 1500 hours worked in that year.

As noted under the capital decline cost per hour (Column G), we ran off the curve provided for the example, but this was to be expected and "zero" was used for the capital decline cost after the machine had accumulated 10,000 hours. It was taken for granted that the normal repair, overhaul and maintenance work will be done on this machine and by this time it will have reached a low value that will have only an insignificant drop with additional hours worked.

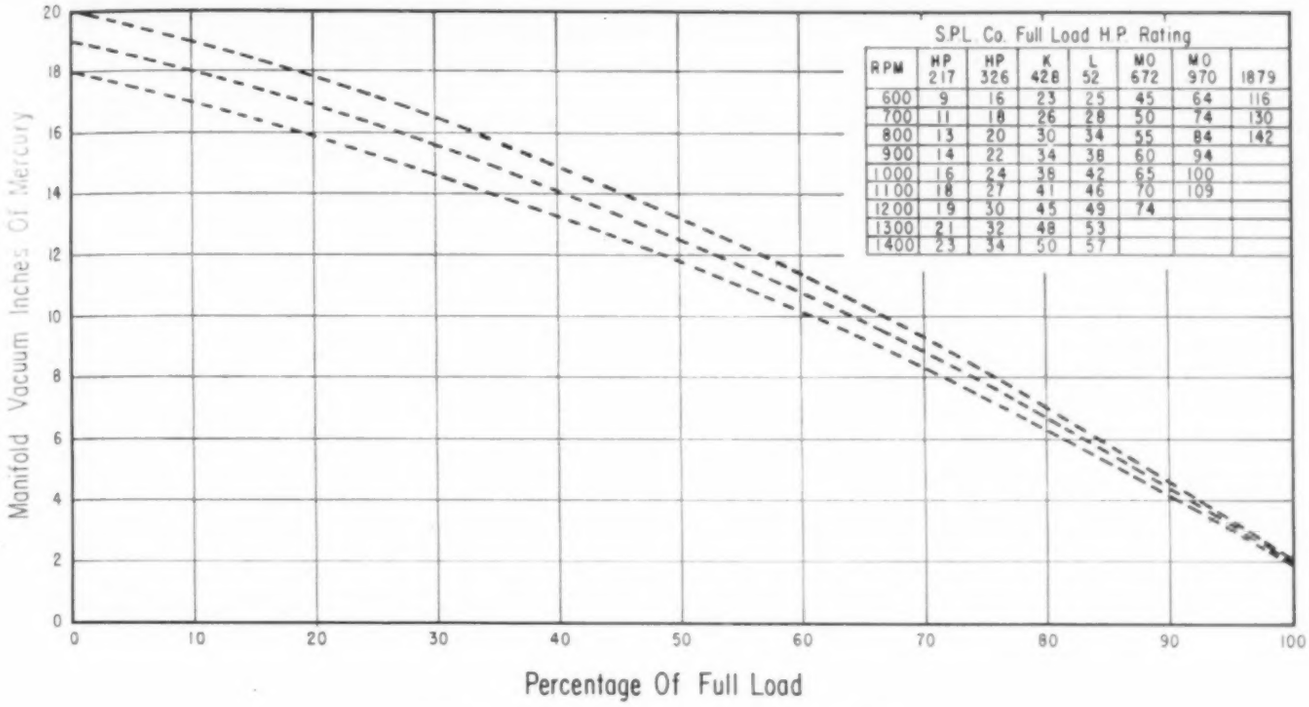
CHART 6

Work Sheet for Determining Economic Life of Track-Type Tractors

	YEARS									
	1	2	3	4	5	6	7	8	9	10
Hours Operated Each Year	1800	1800	1800	1500	1500	1500	1500	1500	1500	1500
Total Hours at End of Year	1800	3600	5400	6900	8400	9900	11400	12900	14400	15900
Major Components	**REPAIR AND OVERHAUL COST PER HOUR**									
Engine	0	0	0	.12	.12	.12	.12	.23	.23	.23
Steering Clutches	0	0	.09	.09	.09	.09	.09	.09	.09	.09
Brakes	.07	.07	.07	.07	.07	.07	.07	.07	.07	.07
Tracks	0	.62	.62	.62	.62	.62	.62	.62	.62	.62
Cable Control	0	.03	.03	.07	.07	.06	.06	.07	.07	.07
Roller Frame & Sprocket Group	0	0	.38	.38	.38	.38	.49	.49	.49	.55
Master Clutch (oil type)	0	0	0	0	0	0	.06	.06	.06	.06
End Bits & Cutting Edges	.08	.08	.08	.08	.08	.08	.08	.08	.08	.08
Transmission & Final Drives	0	0	0	.14	.14	.14	.14	.29	.29	.29
Guards, Hoods, Fenders	0	.09	.09	.18	.18	.18	.18	.18	.18	.18
Total Repair & Overhaul Cost/Hour	.15	.89	1.36	1.75	1.75	1.74	1.91	2.18	2.18	2.24
Productivity Cost per Hour	0	.20	.40	.60	.80	1.00	1.20	1.40	1.60	1.80
Unavailability Cost per Hour	.40	.50	.70	1.10	1.40	1.70	1.80	1.90	2.00	2.00
Capital Decline Cost per Hour	4.22	1.55	.89	.80	.27	.27	0	0	0	0
Total Cost per Hour*	4.77	3.14	3.35	4.25	4.22	4.71	4.91	5.48	5.78	6.04
Average Hourly Cost if Tractor is Replaced at End of Given Year	4.77	3.95	3.75	3.86	3.93	4.04	4.16	4.31	4.46	4.61

* Excluding Operator, Fuel, Grease, etc.

—The End



S.P.L. Co. Full Load H.P. Rating

RPM	HP 217	HP 326	K 428	L 52	MO 672	MO 970	1879
600	9	16	23	25	45	64	116
700	11	18	26	28	50	74	130
800	13	20	30	34	55	84	142
900	14	22	34	38	60	94	
1000	16	24	38	42	65	100	
1100	18	27	41	46	70	109	
1200	19	30	45	49	74		
1300	21	32	48	53			
1400	23	34	50	57			

TYPICAL ENGINE MANIFOLD DEPRESSION CURVE

Keep Engines Running Smoothly

This set of practical trouble-shooting ideas will be helpful in your own preventive maintenance program.

By C. E. HICKEY
Service Pipe Line Company
Shawnee, Oklahoma

WHILE CERTAIN vital parts of an engine last longer and operate better if not frequently taken apart, it is both foolish and costly to run a pipe line engine until some part fails. Certain tell-tale signs of failure precede 98 percent of all engine breakdowns.

Station personnel who heed these signs know when an engine needs to be overhauled and can avoid breakdowns. There will be no forced interruption of service because of a poor preventive maintenance program. An added bonus: it will not be necessary to dismantle the engine for inspection as often to realize maximum life of all parts.

When selecting an engine for a job, do not choose one too small. It is better to pay more and get one large enough than to try to get by with an engine too small. Do not run an engine at maximum horsepower load and at reduced speed for any length of time.

Certain early engine observations are vital to extending operating life. After a new engine is put into service, check and record such information as compression, firing pressure, vacuum, oil and water pressure and temperature, bearing temperature, horsepower load, engine speed, exhaust temperature, and crankcase pressure. Records are good information only when they are kept accurately, systematically and up-to-date.

Protect Unattended Units by Controls. Where engines are unattended,

they should be equipped with adequate protective shutdown devices for such conditions as low lube oil level, high temperature (both oil and water), overload, overspeed, and excessive vibrations. Periodic checks should be made to insure proper operation. Prevention of a single mechanical failure will pay for automatic shutdown devices on a number of units.

It is a good policy, too, to let the operator and maintenance men know the price of replacement parts put into an engine when a failure or overhaul occurs.

Trouble is detected more easily on larger industrial engines than on smaller ones. Large units are generally slower speed; and each cylinder can be checked independently while the engine is in operation. With the use of a compression indicator, the compression, fire pressure and timing can be determined.

Indicator cards can detect a leaky or bad injection nozzle or bad valves. Generally speaking cards on large engines tell more than do vacuum gages on small engines. There are a number of different types of compression indicators, but the standard pencil and drum type has proven very efficient.

The exhaust temperature of each cylinder can be taken readily with exhaust pyrometers or potentiometers. An engine operating properly will have all cylinders balanced, that is, all will have about the same compression, firing pressure, and exhaust temperature. An engine should not be balanced by the use of an exhaust pyrometer, only; the firing pressure should also be considered.

Thorough Inspection Catches Trouble. On large stationary engines, a crankcase inspection should be made about every 700 or 800 hours running time. Dismantling of engine is not necessary except to take off crankcase doors, put lube oil pressure on oil lines with auxiliary lube pump, and look for any excess oil coming from loose bearing. Look for loose bolts in main and crank bearing and check locks or cotter keys in bolts. Also check for any babbitt or foreign matter in crankcase. About every six months running time (or 4000 hours), the crankshaft should be checked for alignment. Use a dial indicator to take web deflection check. Also use the same indicator to check cap clearance and the pull down of main bearings.

Here are some of the most common causes of mechanical failure:

1. Faulty parts or design of engine.
   a. Soft blocks or shaft.
   b. Engine not designed for the job.
2. Human error.
   a. Wrong type of oil or grease.
   B. Improper operation, overload or overspeed.
   c. Improper assembly of engine.
3. Extensive use of engine before overhaul.
4. Lack of preventive maintenance.

Several factors should be considered before deciding to overhaul:

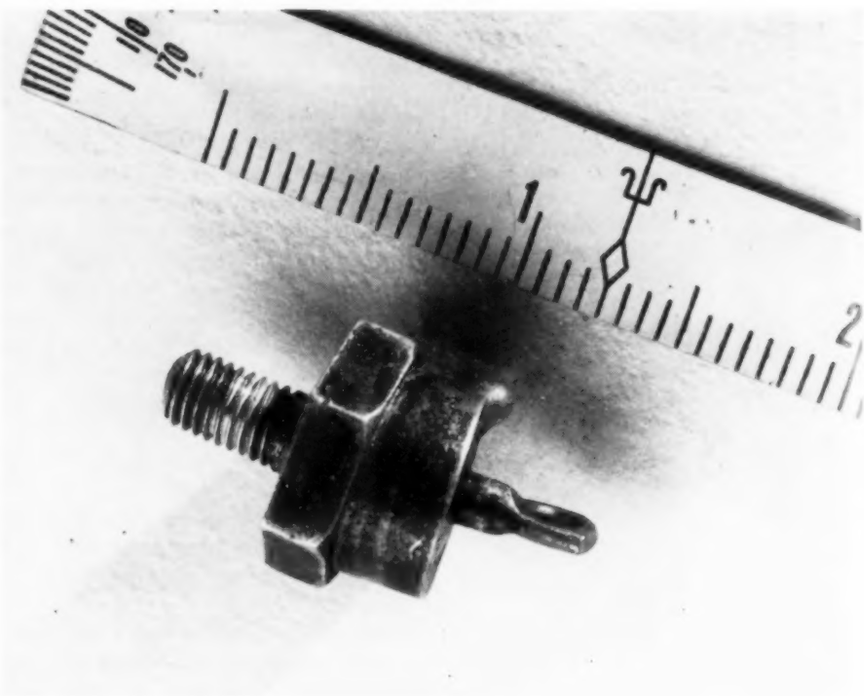
- Total hours run and average load since last overhaul.
- Oil consumption, oil pressure, vacuum on engine and compression of cylinders.
- Engine performance and sound.
- Compare recorded information with information taken immediately after last overhaul.
- Experienced mechanical judgment.

Pyrometers Show Engine Faults. A pyrometer is a sensitive indicating instrument connected to a thermocouple which measures in millivolts the current generated by the action of heat on the thermocouple. The indicating instrument has a moving coil mounted on jeweled pivots between the poles of a permanent magnet.

Deflection of the pointer, or boom, attached to the coil is caused by and proportional to the thermoelectric current passing through the coil, and the current is proportional to the electromotive force developed by the cou-

Tough Silicon Diode Withstands Fire

This 25-amp silicon diode was installed in an oil-immersed rectifier on a cathodic protection system to prevent galvanic action on pipe lines near a Texas refinery. A recent grass fire in the vicinity of the rectifier caused extensive damage to the case. Oil boiled out of the unit and its galvanized case was badly warped. All the galvanizing peeled off the case, too. The silicon diodes when removed and tested retained all of their original operating characteristics; they were reinstalled in a revamped rectifier.



...le. Within the instrument case and ...n series with the coil is a high value ...sistance (usually about 400 ohms), ...hich is designed to compensate for ...e external resistance of the leads ...d the thermocouple itself.

Industrial potentiometers provide ...gh precision of measurement by employing the proven laboratory principle of directly balancing the unknown voltage from the thermocouple ...r other source against the known electromotive force of a dry cell battery.

In service, however, the output of the battery gradually drifts a slight amount, due to aging of the cell and the effects of ambient temperature. For exact reproduction of measurements, therefore, it is necessary to have a means of periodically checking the battery voltage against a standard and compensating for any minor changes in the cell output.

Basically, such standardization of the potentiometer simply involves the use of a constant voltage standard cell which is periodically switched into the bridge circuit in place of the thermocouple or other measured voltage. Any unbalance in the circuit is caused by a change in the dry cell voltage and is corrected by the turning of a rheostat until a null-balance condition is restored. The frequency of this procedure will vary, but it is recommended that each instrument in service be balanced at least once each 24-hour period and preferably twice.

This balancing procedure must not be confused with the mechanical zero-setting which is, in effect, the static balance of the instrument in a horizontal position. Further, the mechanical zero-setting should be made before the instrument is balanced electrically.

Thermocouples Show "Hot Spots." A thermocouple is of two different metals or alloys having a fused junction (the hot junction) is inserted in the exhaust pipe in a protective tube. Lead wires are required to run from the cold end of the thermocouple, which protrudes from exhaust manifold to the pyrometer or potentiometer case.

Vacuum Variation Important. The vacuum gage indicates the difference between outside atmosphere pressure and the degree of vacuum present in the intake manifold.

It is not how much vacuum an engine has but the action of the pointer, both in range covered, and in speed or position changes, that indicates trouble. The amount of fluctuation by the pointer is of far greater value than the exact reading.

Vacuum tests should be made while engine temperatures are normal. More than one type of trouble may exist when vacuum test is taken, and the gage pointer will fluctuate so much that it may be difficult to determine the trouble. It may be necessary to check ignition, compression, or timing before the vacuum test will be a beneficial test.

In normal engine operation at smooth idling speed the pointer should be steady. By opening and closing the throttle wide and fast the vacuum should drop about one-half, then rise slowly back to normal. At idling speed, a steady pointer two or three inches below normal shows late timing, and a steady pointer above normal shows early timing.

Valve leakage should be tested at idling speed. When a valve is leaking, the pointer will drop each time that the cylinder fires. Late valve timing can be detected by a great fluctuation of pointer, engine laboring under normal conditions and running hot.

Sticking valves will make pointer drop each time a valve sticks. Check while the engine is idling.

Exhaust back pressure can be detected by the action of the pointer. With engine idling, open throttle until engine attains normal speed, then close throttle fast. Pointer should go above normal and return quickly and smoothly. If it returns to normal slowly and with uneven jerks, there is probably an obstruction in the exhaust system.

General ignition trouble will make the pointer fluctuate from a little below normal to a little above normal.

If the pointer on the gage shows a slow, floating motion, and the engine checks O.K. otherwise, adjustment of the carburetor is necessary. While adjusting the carburetor, leave vacuum gage connected and watch.

A vacuum gage is a good instrument, but should be used along with compression gage, timing light, and other tools.

When an engine is new, or newly overhauled, it is well to take vacuum tests at different speeds and loads, and record information on a curve to use for future reference.

Some Actual Trouble Shooting Reports

1. Stuck piston in No. 4 cylinder. No. 2 cylinder weak, causing No. 4 to overload. No. 2 Injection nozzles stopped up on account of exhaust and intake valve head chattering when open, bumping end of nozzle. These were oversize valves. With nozzle stopped up the fuel pump could not pump through and put pressure on pump, causing fuel cam to wear off or fuel line to break and even pushed fuel pump off the engine.

2. Engine running with high exhaust temperature: Running hot and sluggish. Compression O.K., fire pressure normal. Valves and timing O.K., but supercharger was stopped up with carbon. If maintenance program of checking and recording information had not been followed engine might have failed.

3. Water in fuel oil: Causes much trouble, especially on dual fuel engines using only about 10 percent crude oil and the rest gas. A bad injection nozzle or fuel pump will make a weak and ragged indicator card.

4. Piston pin plate broken—on oil cooled pistons: If plate breaks, it will cause piston to flood with oil. Oil will go by rings and burn, making a light-colored smoke from exhaust, while smoke from too much fuel oil makes a black smoke. Exhaust temperature will generally go up.

5. Loose main bearings: Will be noticed by drop in lube oil pressure or in check of crankshaft each six months.

6. Ring blow-by: Noticed by crankcase pressure.

7. Bad valves: Can be noted by the fluctuation of manometer or gage of intake air, temperature of valve and loss of power and compression of cylinder. Indicator cards will also help detect valve trouble. —**The End**

Facts About Pump Packings and Seals

Handbook

Part 1 – Packing Boxes and Glands
Part 2 – Packings
Part 3 – Mechanical Seals
Part 4 – Mechanical Seal Maintenance
Part 5 – Packing Maintenance

By HAROLD WOODHOUSE
Dean Hill Pump Company
Indianapolis

THERE ARE many difficult mechanical seal applications operating where regular packing would either be entirely impracticable or have a very short life. The use of a mechanical seal does not guarantee indefinite, trouble-free operation. Sometimes only continuous experimentation with seal materials and construction will add to seal life in a particular difficult application.

The installation instruction manuals of mechanical seal manufacturers usually start with a caution or reminder that the seal is a precision product and should be handled accordingly. Most of the residual opposition to the use of mechanical seals can be traced to failures in operation caused by faulty handling and installation.

The first warning regarding seal handling is that one must be especially careful not to scratch the rotating and stationary seal faces. As shipped, the seal faces are protected from contact with each other or anything else by a piece of soft material, usually cardboard. This should be left in place until actual installation, except to inspect the seal surfaces for nicks, scratches and foreign matter.

If a mechanical seal leaks because of damage to either the rotating or stationary seal faces, these faces must be replaced or re-lapped. Do not jump to the conclusion that because the seal leaks, it is necessarily due to defective seal faces. Other causes for leaks will be discussed. Some seal faces may show well defined circumferential grooving and yet not leak. The nicks, cracks or scratches which cause trouble are those which run transversely across the face permitting flow from high to low pressure side.

Re-Lapping. The question of whether to re-lap or replace depends on the number of seals used in a particular plant. If considerable numbers are used, the purchase of a lapping plate (Figure 1) is warranted. Ordinarily, a finishing lap only is sufficient, but where a considerable number of seals are to be refinished, a roughing lap would speed the work.

Laps are generally made of soft, close grained cast iron. They are made thick to have a rigidity of form but often cored out at the back, as shown, to reduce weight without loss of rigidity. The face has a diagonal pattern of grooves which collect the lapping residue.

After thoroughly cleaning the lap face with a solvent (not with a rag or brush) the surface is charged with diamond powder, in a paste form, and applied with a roller.

If the seal faces are badly scored, the faces can be remachined on a lathe prior to lapping, if *skillfully* done. With bronze faces this is not too difficult; hard materials like stellite call for special cutting tools. Carbon calls for a special technique and is no job to be tackled by an inexperienced machinist. With a prayer that the carbon doesn't chip, one starts from the outside diameter, using a carbide or sharp nosed, high speed tool having a 5-degree lead angle and 7-degree rake, machining inwards with a fine cut.

Bronze and carbon have porous surfaces; therefore, they can become laps themselves, after a lapping operation, because of the embedded diamond compound. Such seal parts can cause seal failure in a few hours; so they should always to washed in a suitable, clean solvent before reassembly.

Seal Leakage. A mechanical seal may leak for reasons other than defective seal faces. Figure 2 with a wedge shaped shaft seal ring at A, which may be teflon and Figure 3 which shows a bellows type shaft seal at *B*, generally of neoprene or buna, are points at which leaks may occur. It is frequently caused by maintenance personnel assembling a seal over a shaft which has burrs either along its length or at the shoulder where the ring is first pushed over the shaft. There, steel burrs cut a groove through the bore of the soft teflon, buna or neoprene ring. This groove may look like an insignificant scratch to inexperienced personnel but it can be sufficient to ruin the seal.

Shaft seal rings are made with a bore to a close tolerance so as to be a *push-fit* over the shaft. If the shaft is not held to the proper tolerance and the ring is a loose fit, leakage will result.

Arrow *C* (Figure 2) points to one of several set-screws which are used to lock the rotating element, of this

type of mechanical seal, on the shaft. The set screws are supposed to lock the rotating element axially so as to maintain dimension 'd' specified by the manufacturer, for that particular size and design of seal. If assembled with dimension 'd' too large, the helical coiled springs, shown, may not be able to maintain the rotating seal face in contact with the stationary seal face (there is a stop pin which limits the axial travel of the rotating seal) and there will be a leak past the gap left between the two seal faces. Sometimes, the set screws come loose and allow the rotating seal to move away from the stationary seal and a similar leakage results.

If a seal is in service a long time, and seals with 8 or 10 years continuous service are not uncommon, one or both of the seal surfaces may wear so much that the maximum permissible axial travel of the rotating seal is used up and contact of the seal surfaces can no longer be maintained.

Another source of leakage, not caused by wear, is the result of crystallization and deposits on all parts of the seal. What then happens is as follows: Because of pump shaft flexibility and a certain amount of run-out of parts, there is a very slight axial movement of the rotating seal face. It is maintained, normally, in contact with the stationary seal face, because it is flexibly mounted and has spring pressure behind it. The pump might be stopped at the shaft position where the rotating element springs are most compressed (i.e. Dimension 'd', Figure 2, for the rotating seal, is a minimum). Then, if deposits or crystallization continue to build up, the rotating elements becomes frozen together as a solid mass and the springs become inoperative and will not be able to move the rotating seal to maintain complete contact when the pump is again started. This condition can build up even if the pump runs continuously.

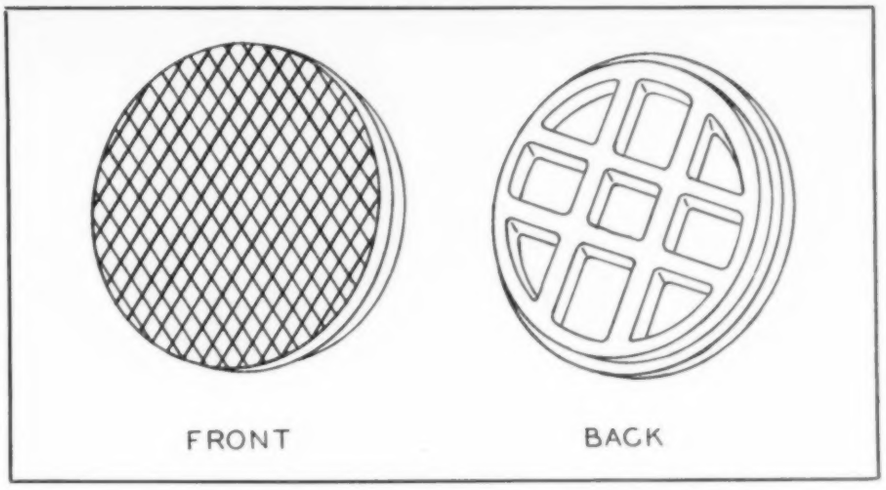


FIGURE 1—Lapping plates have grooved faces to collect residue.

Sometimes such a condition can be corrected by removing and mechanically cleaning each part or by washing in a suitable solvent. However, if a condition of possible crystallization or deposits are known prior to ordering the pump, double seals, or a single seal arranged for flushing, should be specified (See Part 3, "Mechanical Seals").

Before discarding a mechanical seal because of wear, one should not overlook the fact that some designs are made with a reversible stationary seat (see Arrow *E*, Figure 2). By reversing this seat and re-lapping the rotating seal, the assembly is as good as new.

If there is repeated failure of mechanical seals in any one specific application, in spite of excellent maintenance procedures, a reappraisal with the seal manufacturer of the materials used in the seal is in order. Seal manufacturers, like everyone else, are learning by experience, and the particular application might be one in which their experience is limited.

INSTALLATION TIPS

Specific installation instructions are furnished with, and vary for, each design of mechanical seal. Only general instructions which apply regardless of design variations can be given here:

1. If the pump has previously been

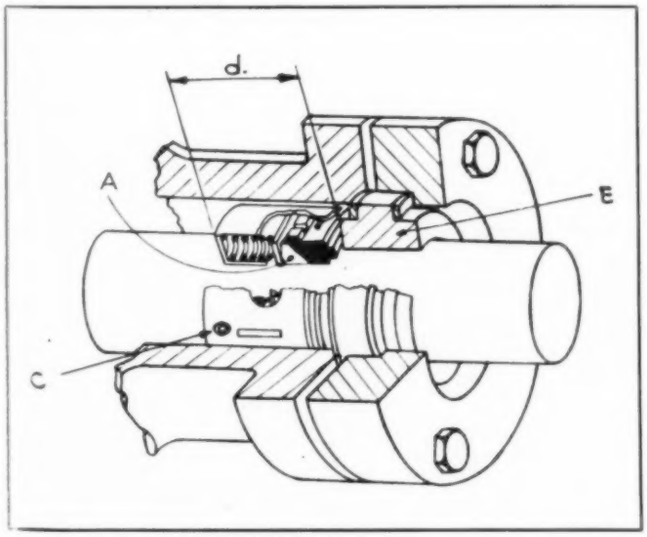


FIGURE 2—Setscrews lock the rotating seal element so that the coil spring can maintain contact with the stationary face.

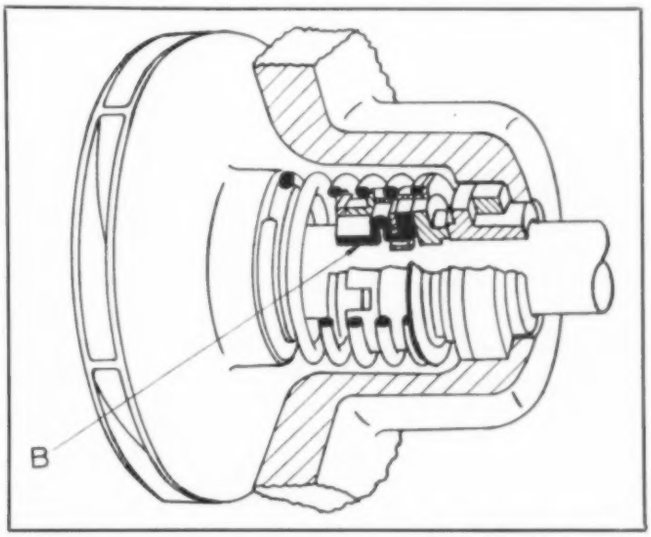


FIGURE 3—Seal leakage may be caused by a faulty, bellows type, shaft seal.

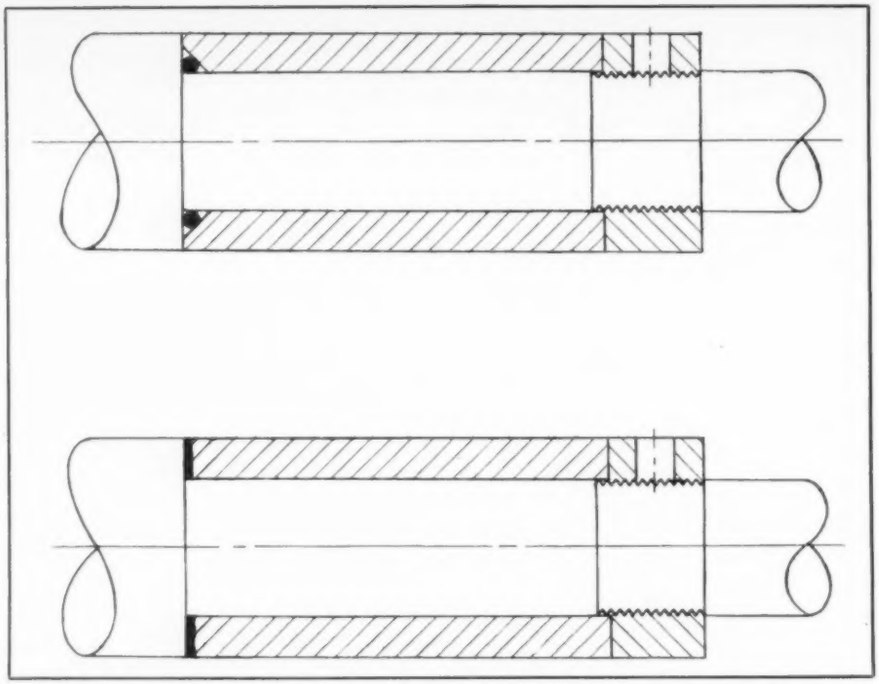


FIGURE 4—For mechanical seals on sleeves rather than a shaft, a gasket or "O" ring prevents leaks at the shoulder.

using packing, the stuffing box should be thoroughly cleaned to remove all traces of packing and, if used, the lantern ring. It may be necessary to plug some holes in the stuffing box wall which will not be required with a mechanical seal. One difficulty, sometimes experienced with packing to seal conversion jobs, is that the stuffing box face must be a machined surface, square with the shaft, against which the stationary seal gland plate may be tightened. Often, with pumps designed only for packing, this surface will have been left unmachined. It is then necessary to set the pump up for this machining operation.

2. Hone all sharp edges of the shaft over which the shaft seal ring must pass.

3. Hone edges of keyways over which the shaft seal ring must pass and fill with wooden, flush keys.

4. Oil shaft with a light oil, not grease, before assembling the shaft seal ring.

5. If any difficulty is experienced in assembling the inner seal ring over the shaft, after taking precautions 2, 3 and 4, check the shaft diameter. It must be within the specified tolerance which, generally, will be only a few thousandths of an inch.

6. Thoroughly clean and oil both seal faces.

7. If the rotating assembly is set for axial location by set screws, check distance 'd', Figure 2, for the correct dimension. If the axial length setting of the seal assembly is determined by the distance between two shoulders or sleeve face or impeller hub face or gland plate face, check this distance.

8. Check all springs and parts for proper seating and the rotating seal face for a slight freedom of movement in all directions, to ensure seating.

9. The shaft must have no end play. This may cause the seal faces to come apart or cause a hammering effect on the faces with subsequent reduction in life.

After Installation of Seal

1. Before starting the pump, where possible, subject seal to a static pressure near the operating pressure, to check for leakage.

2. Where an independent seal lubricating system is provided, see that it is operating before starting the pump. Its pressure should be 10 to 15 pounds per square inch gage greater than the pressure of the pumped liquid, at the point adjacent to the seal.

3. If, a slight leakage is noted after proceeding with step 1, try adjusting slightly, the stationary gland, plate nuts. Particularly with packing to seal conversion jobs, where only two gland bolts are available to tighten the stationary gland plate, the gasket between it and the casing may be improperly tightened allowing a fluid leakage. This can easily be confused with seal face leakage.

Pumps specifically designed for mechanical seals should have three or four gland plate bolts rather than two. If adjusting the gland bolts has no effect on the leakage or reduces it only to a certain minimum without completely eliminating it, do not be too disturbed. If the leakage is not caused by a leaky gland plate gasket, it may cease as the seal faces seat themselves while running. This can take only a few minutes or a few hours.

Maintenance of Seal

1. If seal leakage is observed, do not jump to the conclusion that the seal faces are the cause. It might be a leaky gland plate gasket or shaft seal ring or leakage under a shaft sleeve.

2. If the seal should leak through the gland plate gasket, see if the gland nuts can be tightened. Tighten them carefully and evenly. Do not tighten them so that the gland plate is sprung, as this will cause leakage between the seal faces. If the leak continues, check the stuffing box face for irregularities.

The next step is to install a new gasket. At that time, however, check the condition of the gasket removed, carefully, since it is possible that an unsuitable material, subject to erosive or corrosive action of the pumped liquid, is being used.

3. To check shaft seal ring leakage, it should be removed and its bore inspected. In the act of removing it, note if its fit on the shaft is what is described as a *push-fit*. A running type of fit would definitely allow leakage along the shaft.

If the bore of the seal ring shows any transverse scratch, it probably was cut at the time the ring was assembled, by a burr on the shaft. If the shaft burr or burrs are not removed, then they will similarly damage any new shaft seal ring installed. The shaft or shaft sleeve on which the shaft seal ring fits should be lubricated with a light oil to facilitate assembly.

4. Where a mechanical seal fits on a sleeve rather than directly on a shaft there is always the possibility that leakage may seep between the sleeve bore and the shaft. To avoid this leakage the sleeve face must be butted up tightly against a shaft shoulder with a gasket or 'O' ring in between, as shown on Figure 4. The condition of this gasket or 'O' ring should be checked.

5. If the seal rotary and stationary faces are cracked, scratched or badly

urn, they are probably the source of akage and should be replaced. Do t, however, replace these parts, or complete seal, without giving some ought to the cause of failure, parcularly if the seal life has been short. heck for shaft end-play which allows al faces to come apart or hammer gether.

Check that spring retainer is located axially on the shaft to give the correct compression on the seal spring or springs. The locating setscrews may have been improperly placed to begin with or they may have backed off in operation. Where axial location is dependent on sleeve or shaft shoulder or distance piece, check for proper setting.

6. If seal faces fail, check to determine that they have been properly lubricated.

Like all rubbing surfaces, the rotary and stationary seal faces will generate a frictional heat which may result in their reaching a high temperature with galling of their mating surfaces and seal failure, if they are not lubricated.

Lack of lubrication is, therefore, one of the points to be considered in evaluating some cases of seal failure. Do not conclude that because a lubrication line to the stuffing box is not clogged or that there is clearance past a close running sleeve, allowing some flow into the stuffing box, that the seal has been adequately lubricated.

In some instances the pressure of the lubricating liquid piped to the stuffing box, in the space around the seal, has been lower than the vapor pressure corresponding to its temperature. The result has been that the lubricating liquid has flashed into vapor and failed to provide sufficient lubrication. The obvious solutions are either to increase the lubricating liquid pressure or reduce its temperature.

Where the lubricating liquid is the pumped liquid and the amount of flow to the stuffing box is limited by the restricted clearance past a rotating sleeve or collar (see Figures 1 and 11, Part 3, this series), the flow may be insufficient to keep the liquid below the vapor flashing point because of the input to it of frictional heat from the rubbing seal faces. It may be sufficient to increase the clearance, thereby permitting more flow into the stuffing box. But, in some instances, it may be necessary to provide better circulation to carry away the heat by adding an outlet connection to the stuffing box where the lubricant may be withdrawn.

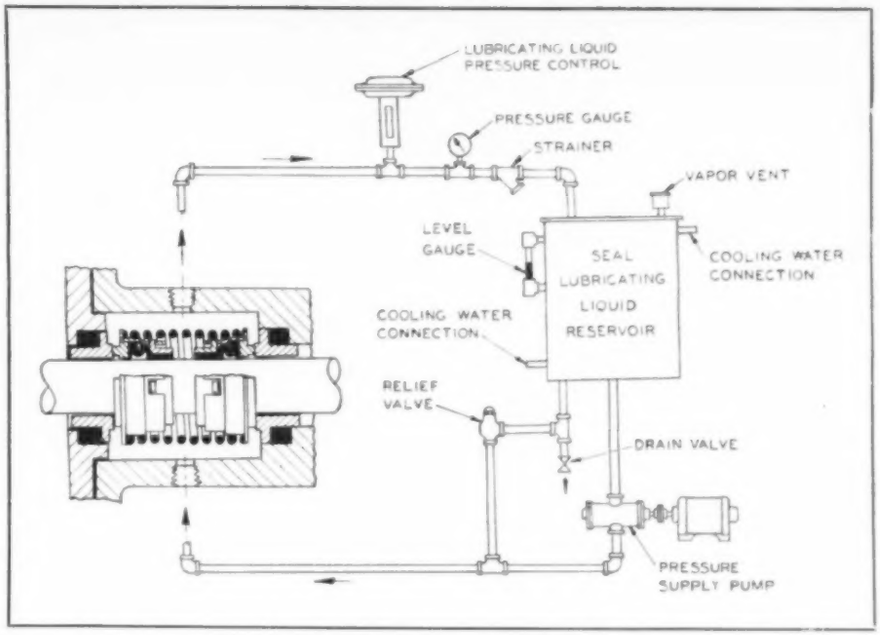


FIGURE 5—Elaborate arrangement of external seal lubricating system.

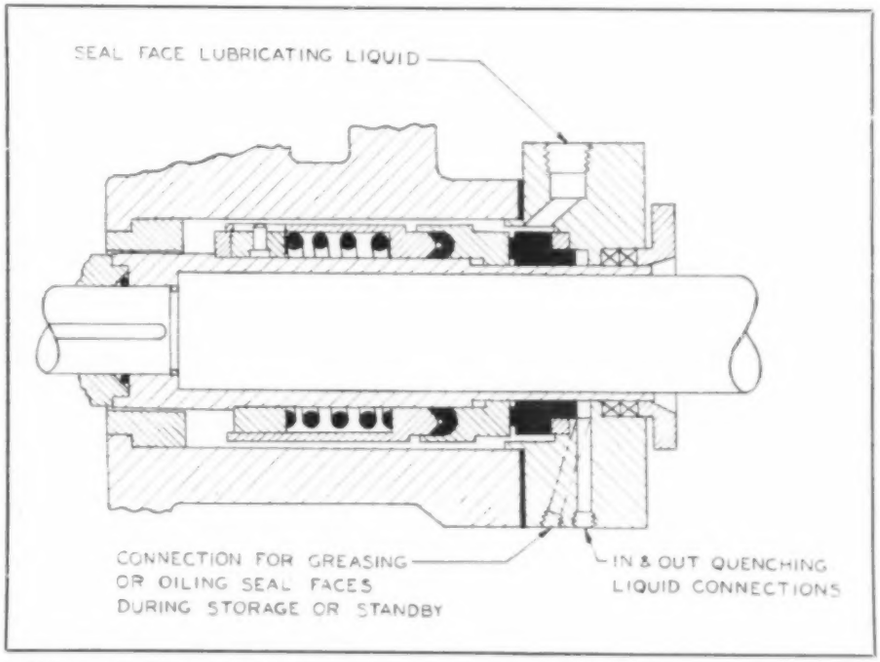

SEAL FACE LUBRICATING LIQUID
CONNECTION FOR GREASING OR OILING SEAL FACES DURING STORAGE OR STANDBY
IN & OUT QUENCHING LIQUID CONNECTIONS

FIGURE 6—Some seals can be lubricated externally for shipping, storage or idle standby protection.

In many instances where the pumped liquid is unsuitable for use as a seal lubricant it is necessary to provide the rather elaborate arrangement shown by Figure 5 for seal lubrication.

7. Where the seal lubricant is piped from the pump discharge to the seal and it is an inflammable, explosive, toxic or expensive liquid, give consideration to putting an orifice in this line. Then, in the event of complete failure of the seal there will not be an extensive, disastrous or expensive loss of liquid.

8. Some pumps, especially if purchased for standby service, may have provision for oiling or greasing the seal faces to protect them during shipment, storage or idle standby. Check that this is done. Figure 6 illustrates such a design.

Part 5 of this series will appear in the October issue of PIPE LINE INDUSTRY

Special Maintenance Report

Chrome Plating Reduces Engine Ring Wear

Chrome plating of compression rings in 4-cylinder pipe line engines can increase ring life to 30,000 hours.

By HELMUTH G. BRAENDEL
Vice President Engineering and Production
Wilkening Manufacturing Co.
Philadelphia

THE DRIVE for longer life, better oil control, better blowby control resulting in cleaner lube oil and fewer filter changes goes on without abatement. It is an essential factor in the economic operation of pipe line pumping engines. Chrome plating of the compression rings has made ring life of 30,000 to 40,000 hours possible.

Despite all efforts to improve ring designs and employ better ring materials, the piston ring is still subject to more wear than any other part in an engine. It is hardly surprising that this is so, since it is subjected to an apparently impossible combination of adverse operating conditions. It must seal very high gas pressures at elevated temperatures and high relative rubbing velocities, with absolute minimum consumption of lube oil. It must do this for periods of tens of thousands of hours without suffering in sealing performance.

Chrome Plating Developed During World War II. Chrome plating on piston rings was introduced during the war in high-output aircraft and ordnance engines in an effort to reduce ring and cylinder wear when our mechanized equipment first entered into service in North Africa. North African desert dust is extremely fine but highly abrasive and our engines initially lasted only approximately 50 hours before being completely worn out. Improving the oil bath air cleaners from an efficiency of 95 percent to 99 percent helped considerably to lengthen the engine life to between 100 and 200 hours, which was still too short. Chrome plating was tried to further increase engine life.

Before this was tried, most engineers had deep misgivings that it could succeed. After all, chrome is an extremely hard surface and it was felt that although it would reduce ring wear it would increase cylinder wear. All efforts in selecting piston ring materials in the past had been to use an extremely open structure with large flake graphite which was relatively soft, porous, and, as a consequence, enjoyed a high margin of safety against scuffing under marginal lubrication.

"Porous Chrome" Rings Reduce Wear. The very hard, impervious chrome plating, although it was reverse etched, or so-called "porous chrome," represented a complete deviation from accepted ring practices. Initial results were successful beyond all expectations. To duplicate the very dusty conditions encountered in North Africa, an ordnance standard dust was prepared having the same range and distribution of particle size and the same abrasiveness as the natural dust encountered in the field. This dust was admitted to the cylinders through the induction system in the same quantity in which the engine normally digested it after the extremely dusty air passed through the oil bath air cleaner. Employing chrome plating on the part of the top ring increased engine and ring life between 300 percent and 400 percent over the identical combination without a chrome top ring. Using a second

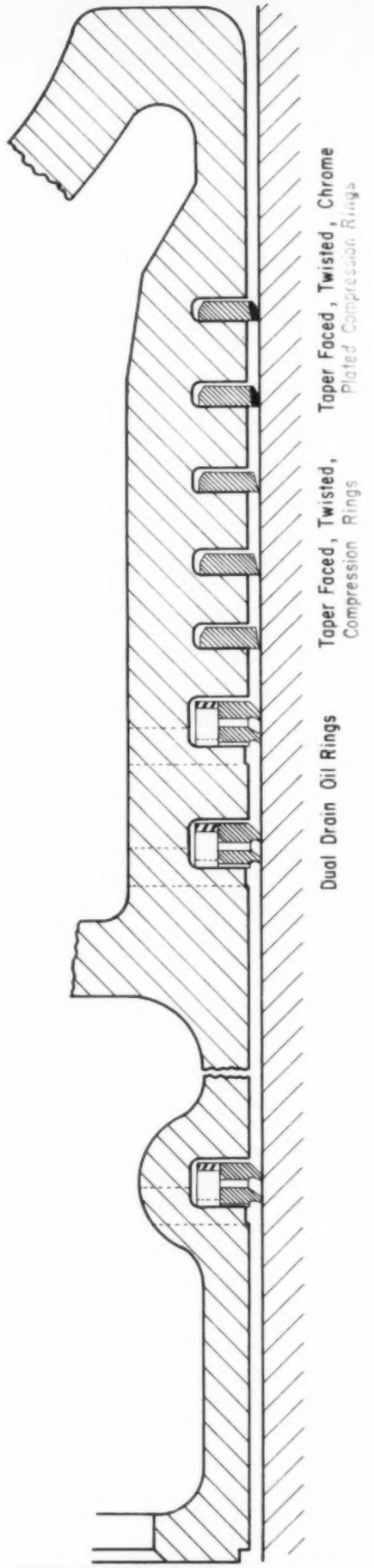


FIGURE 1—Typical 4-cycle engine installation with chrome rings.

Taper Faced, Twisted, Chrome Plated Compression Rings

Taper Faced, Twisted, Compression Rings

Dual Drain Oil Rings

hrome plated ring in addition gave a further improvement of between 10 percent and 15 percent.

Cylinder Wear Less, Too. Although it was expected that cylinder wear would increase, actually the cylinders, and also the plain cast-iron rings below the top rings, showed a reduction in wear in the order of three to four times. When the tests were repeated under normal clean air conditions, the wear of rings and cylinders was still reduced in the order of two to three times that of the engine run under the same conditions without chrome top rings.

For some time, engineers found it difficult to explain the unexpected good performance of chrome-plated rings, especially the reasons why cylinder wear was reduced to such an extent. It was felt that the hard chrome would induce, if anything, higher wear than the soft cast iron rings.

How Chrome Plating Works. Chrome plating the top rings helps reduce all three types of wear occurring in an engine:

1. **Scuff wear.** Under normal conditions at high loadings this is probably the most prevalent type of wear in engines operating. It is caused by a temporary failure of the oil film, permitting the surface of the ring and the surface of the cylinder to make metallic contact. The resultant high friction generated raises the two surfaces to the melting temperature where they actually weld together and are simultaneously pulled apart, producing the typical vertical lines in both rings and cylinders. In extreme cases this will result in scoring and seizure.

Chrome plating on the part of one surface will resist scuffing because of two reasons:

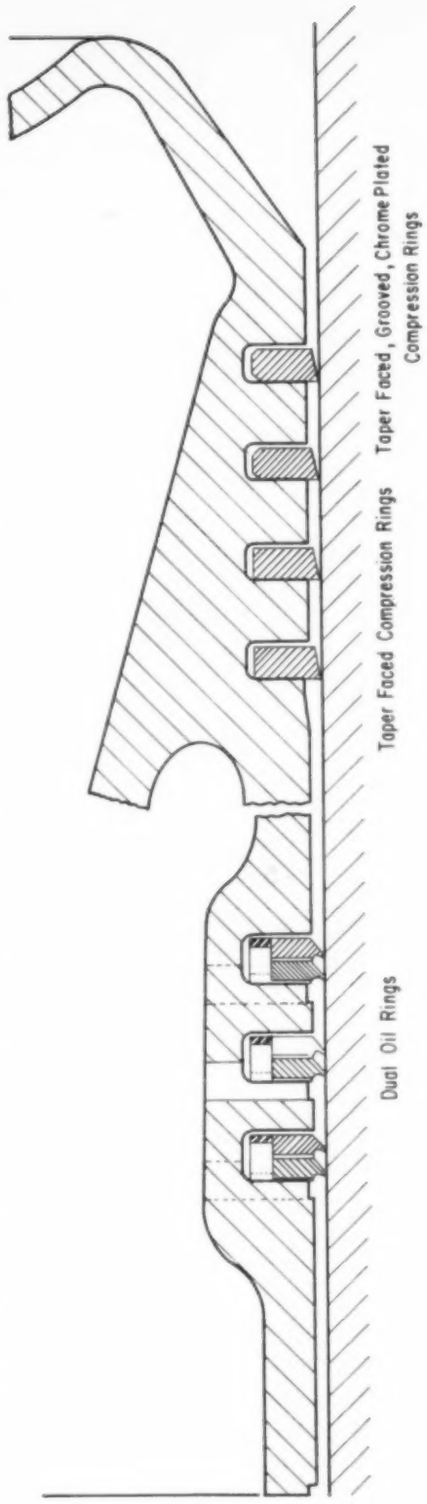
A. Chrome melts at a much higher temperature than iron.

B. It is a dissimilar metal and, therefore, welds with great difficulty, even if brought to the melting temperature.

In some engines chrome plated top rings have been installed for the main purpose of resisting scuffing.

2. **Abrasive wear.** Chrome plating being extremely hard, wears less than the soft cast iron ring surface under dirty or dusty conditions.

A chrome plated surface is highly impervious so that abrasive particles



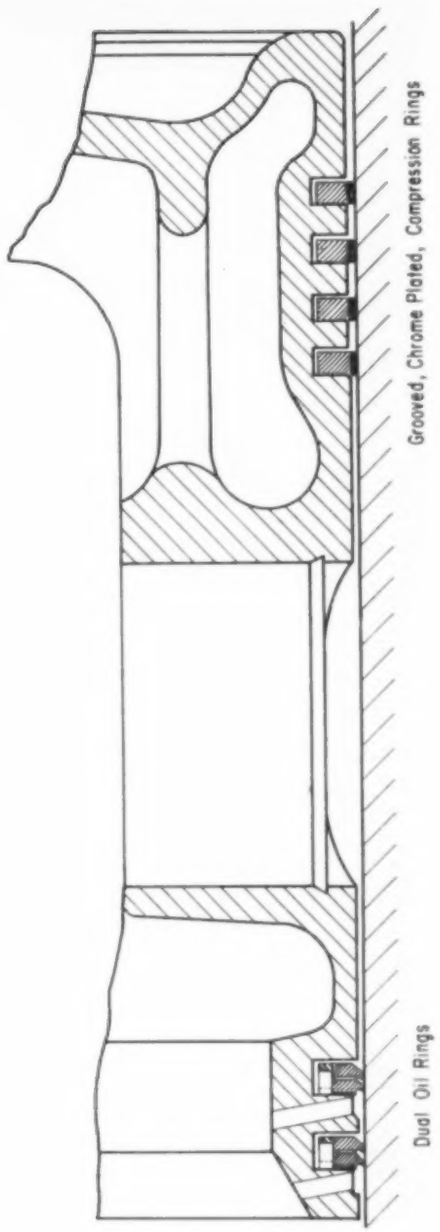


FIGURE 2 (left)—Typical large 2-cycle engine installation with chrome rings.

FIGURE 3 (above)—Small bore high-speed 2-cycle engine installation.

cannot imbed themselves into the ring surface and lap out the cylinder. Since they find it difficult to imbed themselves into this surface, fewer of these particles reach the cast iron rings operating in the lower grooves. Consequently, these rings also wear less when chrome plated rings are employed in the top or top two grooves.

3. **Acid Corrosion.** Corrosive wear is induced by sulphurous and sulphuric acids which are products of combustion from sour or high sulphur content fuels. Acids will attack iron much more readily than a chrome surface. Unless chrome-plated cylinders are used, 4-cycle heavy duty engines employ a top or two top chrome plated rings.

Ring Also Plated For 2-Cycle Engines. Chrome plating has not been used as extensively in 2-cycle engines, probably because when first tried the art of adhering the chrome to the cast iron was not sufficiently developed to prevent occasional chrome

allation

1957

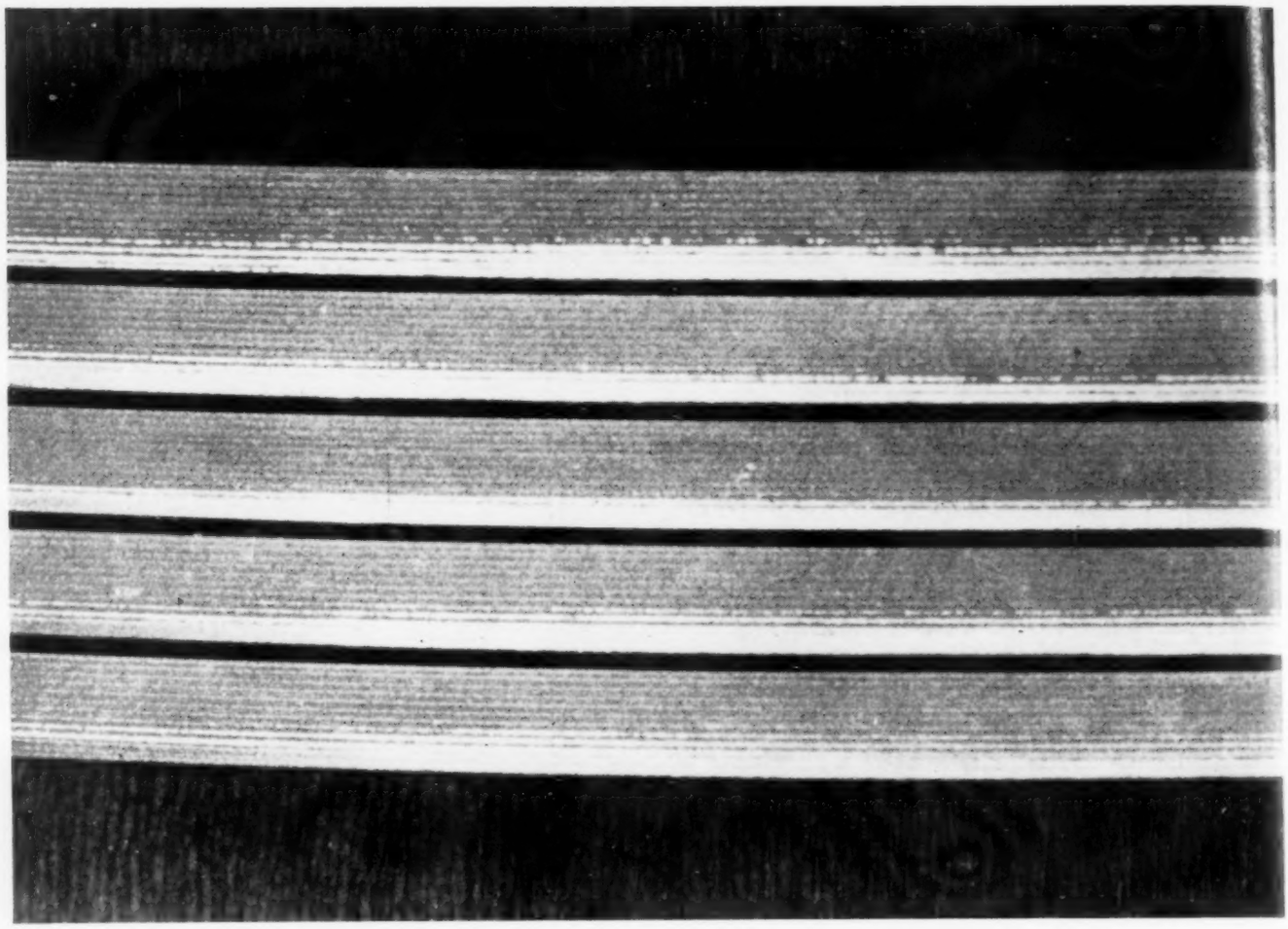


FIGURE 4—Prelapped chrome rings for a 15½ inch bore 4-cycle engine.

bond failure when the rings passed over the ports.

During the past three years chrome-plated compression rings have again been employed in large 2-cycle engines. So far the results are not conclusive since they have not been operating for a sufficient number of hours. In smaller 2-cycle engines, all of the compression rings are now chrome plated. Starting first with the top ring this practice then went to the two top rings, and finally ended with all chrome rings as experience indicated its advantages despite the relatively high cost. It is anticipated that chrome-plated rings will be more extensiveiy used in larger diameter 2-cycle engines in the future.

"Solid Chrome" Replaces "Porous Chrome." Initially, all chrome rings were known as "porous chrome," developed by Van der Horst, because it was first felt that the hard chrome surface would have insufficient affinity for lubricating oil. Porous chrome is produced by reverse etching the rings after the chrome plating process is completed. Reverse etching dissolves part of the surface, leaving it rather rough.

Experiments with rings plated with hard solid chrome disclosed that such rings gave greater uniformity of performance and life, without suffering any greater susceptibility to scuffing.

Chrome-plated cylinders are now being used in several high-output railroad diesel engines as original equipment. Chrome rings and cylinders, of course, should never be used together because the two surfaces lack compatability and will cause immediate failure.

Cylinders Last Longer Too. The relative life of chrome-plated cylinders, as against iron cylinders with chrome-plated rings, is in the order of four to five to one in favor of the chrome-plated cylinders. Of course, this is offset by a much greater relative cost so that the economies of using chrome-plated cylinders as against chrome-plated rings is seriously questioned.

Engine Size Determines Number of Rings Plated. In large engines chrome-plated rings have been restricted generally to compression rings. In the smaller heavy duty engines and in a number of automotive engines, chrome plating is now being employed very successfully on oil rings as well.

One of the next major developments in the large engine field may be the use of chrome-plated oil control rings. This, of course, would again have to be justified economically. Some of the conformable type oil rings now being employed in large engines show extremely little wear for periods of 30,000 hours. Since large engines generally enjoy better operating conditions with respect to cleanliness than the smaller engines, chrome plating of oil control rings, which increases the cost, generally has not been justified economically.—**The End**

Controlling Fires of High Vapor Pressure Liquids

This series of case histories points up the requirements of handling liquids with high vapor pressures.

By **J. L. RISINGER**
Fire and Safety Consultant
Maplewood, N. J.

A NEWS REPORT told of a tank vent fire which split open the roof of a tank, spraying burning oil on volunteer firemen.

Case No. 1

Investigation revealed that a high pressure storage sphere was placed in a depression so spillage could accumulate. On top of the sphere, the large vent had two crooks pointed downward toward the dome so that a vent fire would play a blow torch-like flame on the dome above liquid level.

Some 250 feet from the sphere a flame burned under an asphalt container to heat the product so it could be pumped. The vent fire was not a regular vent fire on a cone roof tank but a vent fire on a sphere containing at the time aviation gasoline. Since, however, the vapor pressure of any product is dependent upon the temperature of the oil, the vapor pressure was high at the time from heat around the sphere.

The sphere was not equipped with water spray or ring to be applied either automatically or manually, and emphasis had not been placed on the importance of cooling water in case of fire around these spheres.

The order of events leading up to the explosion were as follows:

1. Leakage spilled the high vapor pressure product in the depression around the spheroid.
2. The vapors from this leakage traveled to the flames under the asphalt tank.
3. These vapors flashed back to their source, the accumulated high vapor pressure product at the base of the spheroid, and the sphere was thus in a fire pot.
4. As planned, when the sphere was heated, the vents at the top of the sphere opened up and caught on fire.
5. These vents being turned down started a blow torch flame on the dome of the sphere above the liquid level, and there was no liquid inside at that point to conduct the heat through the steel into the oil, thus the steel began to become very hot and weaken, just as would an aluminum pan on the fire without water in it.
6. Volunteer firemen came to the scene and devoted their attention to fighting the big fire around the spheroid.
7. The vent functioned to relieve the pressure to an extent that the strength of the steel of the sphere would have withstood the pressure. However, the steel, heated almost to the melting point by the blow torch effect at the top of the dome, was not strong enough to withstand this pressure. The dome ripped open pulling the steel to a thin melted edge at the break.
8. Liquid spewed out as from a tomato can placed on the fire and the hot heavy burning ends of the product dropped out of the atmosphere onto the people.

In the construction and operation of this spheroid, several seemingly small items were overlooked. They were obvious after the catastrophe occurred. The three chief errors, the avoiding of any one of which would have prevented the catastrophe included one in layout, one in design and construction and one in fire fighting. These corrective measures will be found under the headings mentioned.

Case No. 2

About 10 years ago, a large spheroid was involved in a fire. The rise in temperature raised the vapor pressure. The fire against the shell above the liquid level weakened the steel. The sphere gave way and a part of it weighing many tons landed on the dike surrounding another sphere, providing a fire around it—and it also ruptured.

What occurred in this case was as follows:

1. Several spheres almost a mile from refinery units were placed in depressions with high dikes around each.
2. Pumps and lines were located in the dikes with pump almost under the large sphere.
3. The spheres were on supports.
4. There was no water spray or ring installed to keep the tank cool above liquid level to prevent weakening of the shell above liquid level.
5. Excess pressure vents on the spheres were at low capacity.

6. The product in the sphere had an RVP of about 16 pounds per square inch.

7. The sphere was filled to about 50 percent capacity.

8. A leak occurred, and the rapidly evaporating product accumulated around the sphere.

9. The vapors overfilled the dikes and the cloud of accumulated vapors drifted to a switch engine some 600 yards away. It was ignited, and the fire flashed back to the source, the spilled liquid around the sphere. No one was injured in this fire as the refinery manager, recognizing the hazard of these spheres involved in a fire, cleared personnel out of the danger area.

On another occasion a butane line broke and was playing a jet of flame on a tower. Trained firemen quickly directed a stream of water on the tower at the spot and kept this water stream so directed for the duration of the fire, which was until the flow could be cut off and thus the flame stopped. In this case nothing occurred.

In another case almost identical with this one, no water was directed onto the tower at the spot where the flames were playing. The tower was heated to a point where the supports were weakened, and it turned over spreading the fire and causing several fatalities.

These stories could continue with descriptions of spillage and fire around containers of high vapor pressure products.

Know Your Product Characteristics. The many experiences that could be related do not condemn these products as uncontrollable hazards to life and property. They do emphasize the importance of measures of control of these products in accordance with the characteristics of the products.

The products stored in spheroids may vary from aviation gasoline with a Reid Vapor Pressure (pressure at 100° F.) of from 5 psi to 7 psi; motor gasoline with an RVP of from 7 to 12 psi to products that remain in liquid state only under pressure or at a very low temperature.

The chief use of spheroids, however, is for the storage of such products as butane and propane which have RVP vapor pressures ranging from 15 psi to in the low 20's. Liquefied petroleum gases are usually mixtures of butane, propane and other gases in accordance with the climate in which used.

In handling and storing these gases it is important to remember that they are approximately two times as heavy as air. They will settle in low places, travel along depressions, sink down into openings in buildings and settle in pump locations if pumps are below ground level. They will travel farther before being dissipated than will vapors from open surfaces of gasoline and other lower vapor pressure products.

Vapors from gasoline are formed by contact with the air. The gas cloud formed when butane pressure is released is pushed along by a current of air for great distances before becoming sufficiently diffused as to be too lean to become ignited. It is to be kept in mind that when containers are filled with these very high vapor pressure products, they are kept in liquid form by their own vapor pressure. The flashpoints of these products are too low to be of significance in their description.

When a sphere, cylinder or tank of these products is involved in a fire around them, the pressure rise is such that sometimes even very extensive venting will not relieve it sufficiently to overcome any weakening of the steel above liquid level. Thus it is very important that spheres or tanks containing these products be so plotted that neither the product itself nor spillage from other tanks of any kind of oil will accumulate around them.

Layout and Design. A few suggestions are here offered to lessen the probability of the high vapor pressure product container becoming involved in a fire that would build up a pressure beyond control.

1. At installation, give consideration to ample clearance between tanks and between tanks and property lines.

2. Place regulators etc. well out of tank fire area.

3. Place pumps and connections so that leakage or spillage from breaks will not accumulate or flow under spheres. Often diversion walls or levees of earth are necessary. (Pumps should not be under tanks if it can be avoided.)

4. Provide for rapid evacuation of spillage that might occur under spheres. Sloping grade for channeling or other means, and a location to which products will drain or can be washed and trapped, or permitted to burn at a safe location, is imperative both for prevention and control of fire and explosion.

5. There should be no low spots under or near the base of the container where spillage could accumulate and place the container in a fire pot.

Design and Construction

A. Close check on suitability of materials and equipment prior to and during installation and when any repairs are being made, is of extreme importance.

1. Use of high melting point alloys or steel.

2. The use of steel and welding for piping.

3. Avoid the use of small stuff like ¼ inch. Anything under ½ inch is likely to be flimsy.

4. Allow flexibility and room for heat expansion, also for relief of liquid trapped between closed tank valves.

5. Suitable pumps to withstand service and exposure to heat.

6. Valves capable of withstanding pressure and heat (not cast iron or brass).

7. Although there is no case on record of a tank or spheroid rupturing below liquid level when involved in fire, more attention to bottom strength

than to top strength is suggested, to prevent a first time.

8. Coat columns supporting spheres with the proper thickness of some fire resistant material such as concrete, which will enable the supporting members to withstand the intense heat over a reasonable time without collapse.

9. Install well-screened water spray in suitable volume. Galvanized pipe should be used. Have water pressure available at all times for the spray nozzles on the tops of these pressure storage tanks, and also make arrangements so that the water can be turned into the system from a number of remote points. The extensiveness of this system should be determined by value of other properties exposed.

10. Turn vents upward, or to the side. Never so construct them that in case of a vent fire a blow torch of burning vapors or gas will play against the tank above liquid level.

11. Adequate pressure relief is of major importance. Two suggestions have been offered for relieving excess pressure which is difficult to take care of by safety valves:

(a) A rupture disc arrangement whereby the released gases are piped to a safe location and there burned.

(b) Manually operated relief, remotely located on main vapor line.

B. Provisions should be made for cutting off the flow of the product in case of break or leak.

Steel checks on separate fill lines placed close to the valve on the tank nozzle may be of benefit in case of line breaks. Thermally operated valves on outlets will also be of benefit. This refers to bottom outlets below the liquid level. Manual means to release pressure by opening a valve on the top vapor line at some remote point is desirable.

Double valves should be provided on draw-off lines leading to atmosphere or to open containers from storage vessels containing butane (or lighter products) under pressure where the character of the stocks and magnitude of the pressure might result in appreciable refrigerating effect if the pressure is suddenly released.

It has been suggested that all valves located under these tanks be equipped with extension stems through any diverting walls, in order to close them off in case of emergency.

C. Operations.

1. Maintain constant watch against leaks, cut off the flow to them as soon as possible and correct the damage, taking no chances on exposure to flash.

2. Care must be taken to prevent overflowing the sphere or other container, since the liquid released from the safety valve will form a large volume of vapor which can travel a considerable distance.

D. Fire Fighting.

1. Open container and spill fires in a large quantity of high vapor pressure products, such as carried in spheroids cannot be extinguished by any fire fighting agent or device now known. Furthermore, if such a fire could be extinguished, to do so in most cases would create greater hazards than the existing fire itself, since the unburned vapors might accumulate at other locations.

Therefore, the most effective means of controlling fires in these products is to use plenty of water to keep exposed property cool and shut off flow of product to the fire.

2. Play as much water on the container above liquid level as possible. Even if water spray or other means of water application is fixed, play heavy streams of water on exposed steel above liquid level if this can be done without depleting the water supply.

3. If vent or broken line is playing blow torch flame on steel above liquid level, direct streams of water on this spot. If this can not be done quickly, stay clear of rupture of the container which is almost sure to occur from heat weakening of the steel. Water is very effective in cooling steel in such cases.

4. By all means protect the container above liquid level. It is conceded that a low viscosity product will conduct heat away from the shell of a spheroid faster than would those of high viscosity. The claim that in such products as butane, when heat is applied to the outside of the shell, that a vapor layer is formed next to the shell, thus interfering with heat transfer, is somewhat offset by the fact that there will be a condition of turbulence.

In any event, there is no record of a spheroid rupturing below the product level when heat is applied to it. The rate of this transfer, as it affects vaporization and formation of pressure when determined, will give a clue to the capacity of excess pressure relief needed. The value of water spray cooling and the providing of ample excess pressure relief is emphasized.

5. In the case of a broken line or other such leak, do not extinguish the fire except by shutting off the flow.

It is sometimes feasible to extinguish the fire and then shut off the flow. Fires of considerable sizes can be extinguished by use of dry chemical extinguishers. On large fires of this kind, water fog of spray should be used to protect the approach and cool steel or extinguish wood and rubbish fires against reignition of the gas before source of flare of gas can be cut off.

If flow is not cut off, vapors or gas may accumulate and then when re-ignited the flow will travel back to its source.

—The End

FIGURE 1—This scene speaks for itself. Every day pipe line management is faced with the frustrating problems of incomplete work, dissatisfaction, breakage and inadequate leadership. On the other hand, mounting training needs, demands and the search for the proper plan can prove just as frustrating. The following article is designed to solve most of these problems.

Pattern for Training—Part 1

What Training Should Include

Here are the most effective ways to start and maintain a successful training program as determined by a survey of 50 oil companies.

By CARL MULLINS WHITE, Service Pipe Line Company
Tulsa

THERE ARE two important prerequisites for a successful employe training program:

- Start with a short range plan.
- Design your courses for middle supervisors.

Short-range planning not only will provide a sound beginning, it will form the basis for a more successful long-range program.

Among 50 companies queried in an extensive survey, several approaches were used in setting up short-range courses. However, there is an adage that the most successful courses seem to follow: "Training is like drilling an oil well, it must start at the top and work down." There are two good reasons why this axiom has proved itself: First, enthusiastic support of top management is necessary if the training effort is to achieve its best results.

Second, training in supervisory techniques at lower echelons can prove frustrating and confusing if higher echelons continue to function through old techniques.

On the other hand, there are those who feel that training should begin immediately with the worker. This approach reaches more quickly to more people and perhaps to those who critically need the training.

Where you start in setting up a training program will depend on your needs and on what training your company has already conducted. Certainly worth considering is the idea of starting at the middle and working in both directions—upward in leadership training, downward in talent and job skills development.

The more successful short range training programs include two courses

run in close succession—both directed toward middle supervisors:

The first, "Humans at Work" will help the supervisor:

- Improve his handling of personnel.
- Increase his understanding of human behavior.

The second, "Training for Job Training" will help the supervisor:

- Inventory his work force.
- Determine his training needs.
- Provide instruction (with advice and assistance).
- Maintain training achievement records.
- Follow up, evaluate and improve training procedures.

Humans at Work. Suppose your first pupil will be the middle supervisor. What shall you first offer for his learning? Again this may vary with different situations, but generally, beginning with a supervisory development class is a safe venture.

Most companies consider the foreman or supervisor a key man in the training program, both as an instructor and as a student. In the 1955 survey, it was found that:

- 72% of the companies gave classroom training to their supervisors in human relations.
- 60% of the companies used special instructors to teach foremen human relations.
- 72% of the companies employed the conference method to develop their foremen's human relations skills.

This number has increased. Now it appears that practically every major oil company in the country has in process, completed, or contemplated some sort of supervisor development project.

It is not essential to make a survey to realize this need. The course would begin on points obviously needed. Surveys and other evaluations could be used for determining its exact content or for formulating curricula for sequels to it.

No supervisor was ever above improvement. Most of them ask earnestly for training. Everybody needs more knowledge of human nature.

What the course should contain: Some supervisors have read a great deal of the "how-to-do" in handling personnel problems; others little. Those who have read much may be cynical toward a typical supervisor course. This one ought to go deeper into causes. No matter what the title, it would actually be applied phychology. It would not talk about dendrites and ganglia, or paranoids and schizophrenia. It would deal in simple language with:

1. What a human being wants.
2. How he goes about satisfying those wants.
3. The effect on him of such management tools as:
   - Working conditions—physical and social.
   - Financial returns (salary, benefits).
   - Reprimand.
   - Praise.
   - Counsel (non-directive counsel, advice, merit ratings).
   - Communication (oral instructions, letters, bulletins, opinion polls, surveys, house organs).
   - Training (kinds, methods, means).
   - Appreciation and use of abilities and qualities.
4. How a human being learns.

The course should include conference and case study to bring out applications of the principles discussed. Students can draw practical problems from their own situations. But the emphasis should be on theory and techniques of solving human resources problems rather than on immediate answers.

The course could include some consideration of applied imagination, with emphasis on the use of creative thinking in training and development of employes.

Foremen and supervisors are the key men in any training program, both as instructors and students. Here's the proof:

In a recent survey of 50 oil companies, it was found that:

- **72 per cent of the companies trained their supervisors in human relations.**
- **60 per cent used special instructors to teach foremen human relations.**
- **72 per cent employed the conference method to develop their foremen's human relations skills.**

The closing session should prepare conferees for the second course, "Training for Job Training."

Training for Job Training. Fresh from their study of human values in industry, supervisors will be ready to attack the problem of imparting skills and attitudes to their employes. Like all good training, job training consists of four steps:

1. Determination of training needs.
2. Planning and conducting training.
3. Evaluation and follow-up.
4. Repeating the above three steps.

Determining Training Needs. Determination of training needs always includes, in one form or another:

Making a list of what you want employes to do or believe.

Making a list of qualifications of employes (skills, experiences, attitudes, and knowledge).

Subtracting the latter from the former.

Let's break the above process down into five steps:

1. Listing and describing all the jobs in the unit. (If a complete job analysis has been made, this should be used. Otherwise, the supervisor will make his own.)
2. Forecasting training needs on the basis of expected retirements, new tasks, possible promotions, and other changes.
3. Preparing a description of each employe according to skills, improvement potential, and training needs.
4. Spot checking for training needs. The class will discuss some points for re-checking training needs. Later, on the job, the supervisor and the training specialist will work

together at this task. Some of the points covered will be:

- New or transferred employes.
- Conversion of equipment.
- Excess of faulty work.
- Lowered performance standards.
- Replacement difficulties.
- Excessive overtime.
- High unit cost of production.
- Expanded operations.
- New operations or procedures.
- Anticipated loss of personnel.
- Grievances and complaints.
- High maintenance costs.
- Limited experience of some employes.

5. Deciding what needs to be taught. This means piecing all the above training needs together, grouping into classes all trainees of similar needs and deciding upon the individual training needed for those that cannot be put into classes.

Each supervisor in the course will familiarize himself with the forms and procedures for accomplishing these five steps.

Planning and Conducting the Training. The laws of learning and principles of human behavior previously studied in the applied psychology course will furnish a common background for starting this part of the course.

Students will discuss plans for organizing and conducting training. Using a workshop procedure, they will prepare plans for adding interest and effectiveness to the training of their employes.

Evaluation and Follow-Up. Members of the class will learn how to keep simple training records. They will discuss the importance of recognizing additional skills and better work of employes. They will also consider ways of encouraging interest in self and group improvement.

Repeating the Three Steps. The course will emphasize training as a continuing project, with needs studies, training, and follow-up going on in a never ending circle.

Afterward, on the job, the supervisor should have the advice and help of the training specialist.

Some Practical Arrangements. What about the size of classes? Within limits, the smaller the class the better the training—and the costlier. About 12 or 15 students is large enough to bring an interesting mixture of experiences but small enough to give

Continued on Page 58

If Oil Could Speak

If oil could speak it would have many fascinating truths to tell the non-oil public—truths that would win thousands of new friends for the oil industry.

But, oil can't speak—you can. You, as an individual, can win many new friends for the oil industry if you will pass the true facts on to your non-oil industry friends.

Here are some of those true facts. They are being presented for one purpose: To keep you posted on your industry, so you can tell the story oil is unable to relate.

Read these facts. You will find them informative—and interesting.

"If Oil Could Speak" it would tell the American public:

Are We Running Out of Oil?

In 1956, 58,160 total wells and 31,160 oil wells were completed in the U. S. This rate of drilling maintained over a decade should develop more than 40 billion barrels of new oil.

What Is the Industry Doing to Insure a Future Supply of Oil?

Three billion oil industry dollars bought 58,160 wells, financed 2.5 billion barrels of production and added 1187 million barrels of crude oil to the nation's reserves last year.

Is Oil Hard to Find?

Of the thousands of wells drilled annually in the search for new fields, only one in nine finds some production initially—and only one in 44 finds commercially significant deposits with one million barrels or more of crude oil. Of the acreage leased for production, only about 5 percent proves productive. Even after the discovery of oil, about 25 percent of the wells drilled in the process of developing a field are dry holes because of the difficulty of defining the limits of production.

How Much is Lost on Dry Holes?

Out of about 264,000 wells drilled in the past five years, 38 percent have been dry holes—compared with 25 percent from 1920 to 1941. The cost of dry holes is now in excess of a billion dollars annually, which represents about 40 cents for every barrel of crude oil produced. As a result, about half of all the money spent on exploration and drilling is lost on unsuccessful ventures. Thus, the true cost of successful producing wells averages about twice the amount spent directly on them.

Where Do Oil Industry Profits Go?

In 1957, the domestic petroleum industry will spend about five billion dollars on exploration, drilling and production facilities. It will drill about 60,000 wells. Over the next ten years the industry may drill more than 700,000 wells and spend some 60 to 70 billion dollars to develop new oil and gas resources. To carry out such a program producers must risk all the capital they recover from earlier investments through depreciation and depletion, about half of all their net income after taxes, and substantial additional sums of borrowed money.

To What Extent Has Oil Production Increased in Recent Years?

Today, U. S. producing wells turn out more than 7 million barrels of oil daily—three times the volume produced 25 years ago.

10 Ways to S-T-R-E-T-C-H Those Years

The formula for a healthier, longer life is simple: Give the same attention to your personal "machine" that you give to those in your compressor station.

By **ERNEST W. FAIR,** Boulder, Colo.

"THERE'S NO more cantankerous individual—when it comes to taking care of himself—than the modern business or professional man," a doctor declared recently. "He'll rush the kids to the hospital on the slightest pretext and yell for the family doctor every time his wife looks tired—but take care of himself? He never does it until he's had a good scare at least once!"

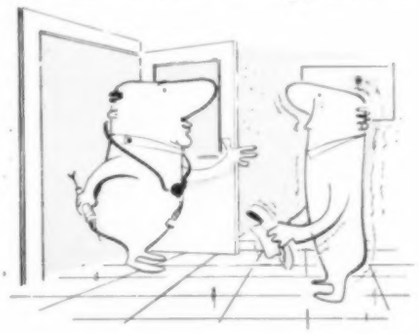
Learning through the "good scare" route isn't wise. Far too often that incident turns out to be the actual end of the line.

"Accumulated nervous tension," another doctor warns, "damages more business men's constitutions than anything else I've noticed. Maybe it's the tempo of today's business or maybe it's something else, but one big thing is that we're not taking enough time to relax anymore."

Relaxing is more important than one may think at first reflection. It should be both mental and physical.

Not one executive in a hundred can go home from his office and forget his business without a powerful interest to completely dominate it. Ordinary pasttime pursuits will provide interludes but not complete freedom. Going on day after day and night after night with concentration on a single theme can put some men on the "happy farm." For most, the result is broken health and inability to properly plan their business lives.

"We never hire a junior executive who hasn't learned to separate his business from his home life," the head of a large national organization says. "The executive who can approach his



business with a fresh and alert mind every morning is the one who has left his business in the office the night before."

It takes top health to have the mental and physical energy to make intelligent decisions—it takes top health to be ready for the unexpected emergencies in the life of one's business—it takes top health to be the kind of business executive who inspires results from the people around him.

There are as many "systems" for guiding one's health as there are subparagraphs in a government regulation. Some are good and some are bad, but medical men generally will advise that "fads" and "easy-to-follow" schemes are generally not only worthless but—what is more important—dangerous!

There is no "magic formula" to good health for any executive. But there are a few steps that every one can use. The results will offer no assurance of living forever but they will give a person more out of the life.

Those steps are as follows:

1. *Know Your Doctor as a Friend.* Too many of us look on the family doctor as the caretaker of our children and of our wives . . . never consider him our own caretaker and friend as well. The doctor's ability to help any of us depends on his knowing all about us *all of the time.*

2. *See the Family Doctor Regularly.* A check-up of one's physical and mental condition is just as important as a maintenance check-up on our equipment. The average life expectancy of all of us has leaped in the past twenty-five years because of the wonders of preventive medicine. None of these advantages can be ours if our doctor cannot discover the need for them early.

3. *Check Every Idea With the Family Doctor.* When we're feeling low, there's always someone ready to step forward with a sure-cure nostrum or a big health idea to solve our problem. Our wisest bet is to listen

courteously and then check with the family doctor before we do anything. Some of those ideas may work well with the other fellow and not only be of no value whatever to us but they can be harmful.

4. *Relax—Mister—Relax!* We can run the motor in our car without rest for just so long, and it will start becoming sluggish, lose its power and demand attention from the "Motor Medic." The same thing holds true for the human body; its ability to keep going at top speed is good, but limited. Slow down, give every part of the body's machine a rest, and it will keep functioning at peak efficiency much longer.

5. *Follow Simple Health Rules.* Medicine has learned a lot in the past twenty years and all for our benefit; but unless we listen and put into practice these principles, all of this accumulated knowledge does no good whatever. Here's a suggestion: Insurance companies are vitally interested in our living as long as possible, so they have all sorts of very good literature on how to prolong life. All you have to do is ask your agent for it—and follow the simple rules of good health laid down in these booklets.

6. *Know the Danger Signs.* When that clatter-bang starts coming out of the family car, you know there's trouble in the engine and rush to a garage. When something goes wrong with a lot of us we reach for a pill and forget all about it until the next time. The clatter-bang is the car engine's warning of trouble—so is that out-of-ordinary clamor in our own physical make-up. It's no time for a pill; it's time to have a check with the family doctor and see what the warning is about so something can be done about it right now.

The great majority of cancer deaths can be avoided, we are told, if it can be spotted in first stages. So can nervous breakdowns, and a lot of other mental and physical ailments. We have a marvelous piece of machinery in the human body, and it's loaded with scores of safety valves and warning signals, if we but listen to the warnings when they occur.

7. *"Worry Gets Most Businessmen."* No matter how tough the problem, how large and hungry the wolf at one's doorstep, or how unsurmountable the latest tax problem appears . . . worry and fret about them will do no good.

"When I catch myself starting to worry about one of my business problems," an engineer commented recently, "I grab my hat and get out of the place as fast as I can—rush home, pack my fishing gear, and head for the nearest angling spot. The problem always waits for me, and when I come back I'm in much better shape to work it out because I didn't let worry completely overpower my ability to reason out the predicament."

8. *"We Can't All Be Henry Kaisers!"* Doctors say over-powering ambition has shortened many a businessman's life from five to twenty years. Trying to do too much always results in fatigue. The physical kind we readily spot; mental fatigue seldom shows up until it's too late.

9. *Develop an Easy Disposition.* That's a large order for many people because of the way they are put together. However, just as frequent high-speed spurts on the automobile engine are damaging; so are tempers, tantrums and fits of anger damaging to the body machine.

10. *Play the Health Odds as Close as You Play Poker Odds.* Few men would pay $100 in a poker game to draw two cards to an inside straight, but they will take on the same impossible odds with their health. Working late three nights in a row is such a procedure—taking on more than you can handle in the business world is another.

You can't live forever, but you can live much longer and enjoy it more fully, if you give the same attention to your personal "machine" as you do to those you use in the main line station. —**The End**

Pattern for Training

Continued from Page 56

each member a fair amount of participation. Materials needed will include: blackboard, tables, chairs, classroom away from interruption, and projectors for both transparent and opaque material.

The applied psychology course will require text material, which may have to be compiled by the training specialist. It will be a careful mixture of established principles and the wealth of new research.

"Training for Job Training" will require handouts, including various blank forms for student practice.

Who should conduct these courses? Generally, training is considered to be a line responsibility and the larger portion of it has to be done by the supervisors. But these courses are different from the common run. They require leadership by someone with professional education in psychology, course building, and instruction methods. If the company has a training specialist with those qualifications, it appears that he should conduct these two courses. If not, outside help should be arranged.

Benefits of Short-Range Planning. Some of the results claimed for these courses are:

- Having replacements ready when needed.
- Better productivity of present work force.
- Systematic passing along of "know how" to employes.
- Promotion of employes based on proven ability.
- Easy conversion of skills when changes in operations occur.
- Improvement of the human relations situation.

These are strong claims, but they are not exaggerated. Teaching a worker his job means more than merely adding to his mechanical skill. It gives him a feeling that he belongs and that someone is interested in his progress. Helping a supervisor learn skills in training his workers creates both immediate and chain-reaction values.

The stage should be skillfully set to stir in each individual conferee the curiosity and the opportunity to study personnel and training problems.

Part 2 will appear in an early issue of PIPE LINE INDUSTRY.

ALCO TRIMS WEIGHT BOOSTS POWER CUTS COSTS IN MODERN 251 DIESELS

The ALCO 251 diesel is made for today's requirements of stationary service. Its base and block are rugged weldments for lower weight, higher strength than old-time castings. Four-point mounting eliminates grouting and heavy foundation costs. Use of modern proven materials in the power section extends the life of the 251 diesel, too, and maintenance is easier and less costly.

More power per pound is provided by improved fuel injection, modern turbosupercharging plus an air aftercooler. The basic 251 diesel can be easily adapted to any stationary service by simply adding standard parts, including dual fuel, and it is especially suitable for automatic or remote operation.

ALCO's regional warehouses — seven located throughout the country — give speedy service on parts orders. This, plus the fact that all models of the 251 diesel have interchangeable parts, means that your parts inventories can be kept low.

If you would like more information on the advantages of the ALCO 251 diesel, contact your nearest ALCO sales office, or, if you wish, write for Bulletin DE-6 to Transportation Products Division, Dept. TR-3, P. O. Box 1065, Schenectady 1, N. Y.

Condensed Specifications for ALCO 251 Diesels

No. Cyl.	Bore and Stroke (in.)	RPM Range	BHP Range	Approx. Wt Dry (lb)
6	9 x 10½	350-1000	550-900	22,100
12	9 x 10½	350-1000	1100-1800	32,650
16	9 x 10½	350-1000	1470-2400	42,000

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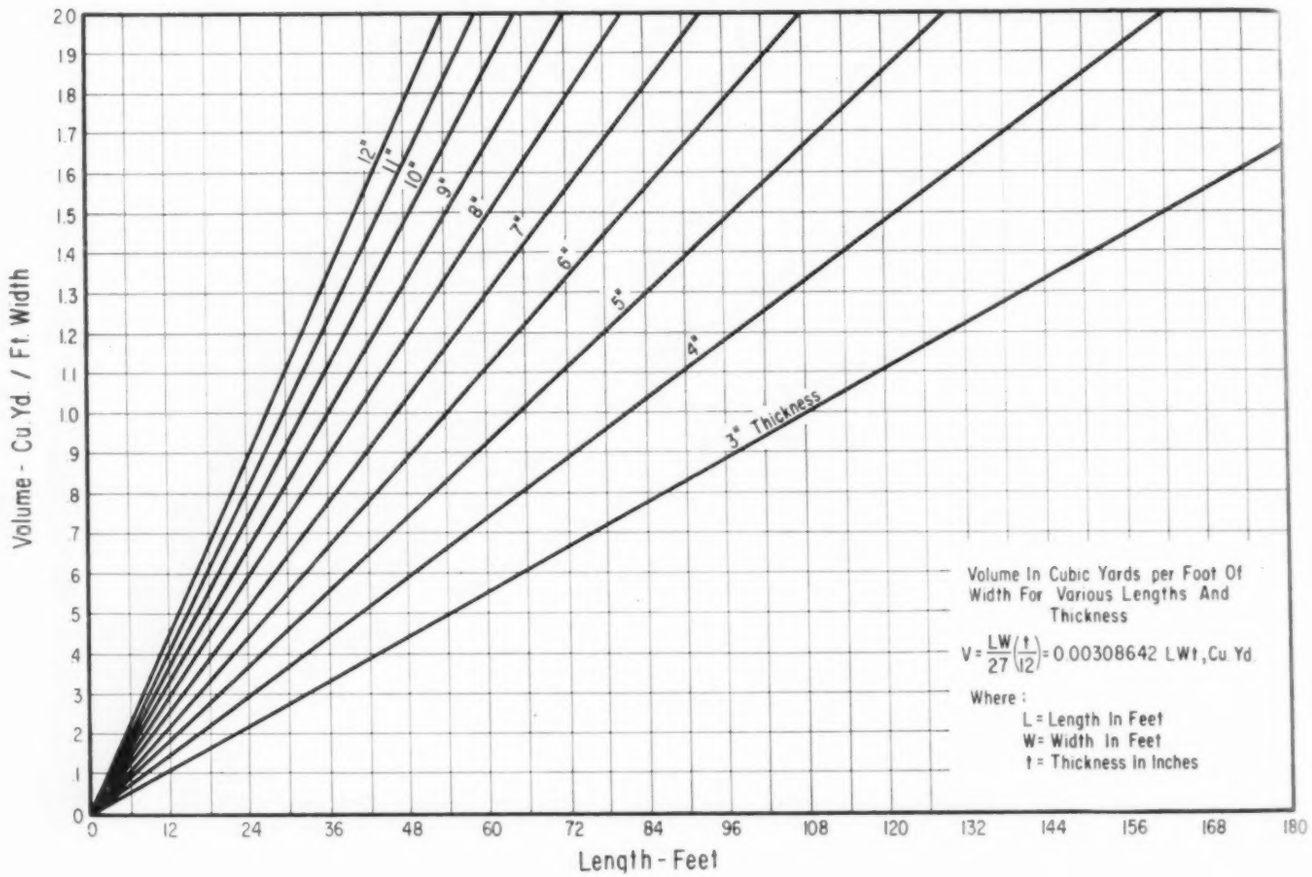


Engineering Design

—33—Graph for determining volume for pads of various lengths and thickness

This handy graph quickly gives the volume of fill needed in construction of pads. The volume per foot of width can be read directly using the length of the pad and the thickness required.

Example:

Given: Length—84 feet
Thickness—5 inches
Width—20 feet

To determine the volume per foot of width read up from 84 feet until the diagonal line of 5 inches is intersected, then read the volume from the ordinate which is 1.3 cubic yards per foot. Since the pad is to be 20 feet wide, the total volume will be 26 cubic yards.

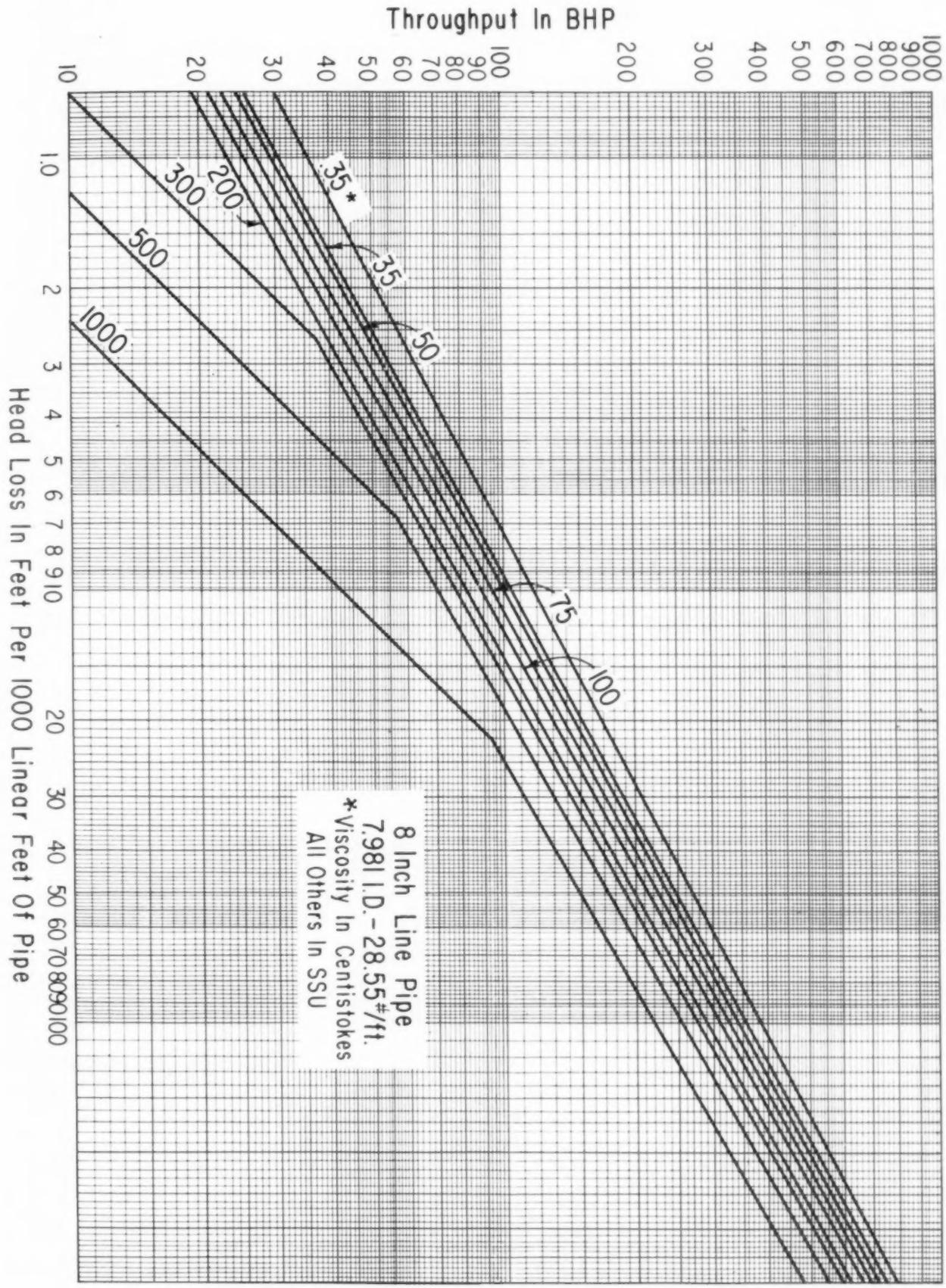
Engineering Design

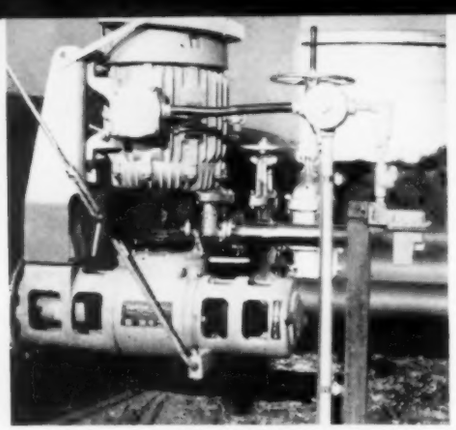
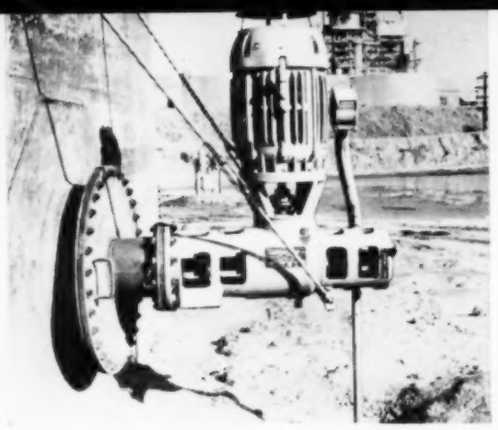
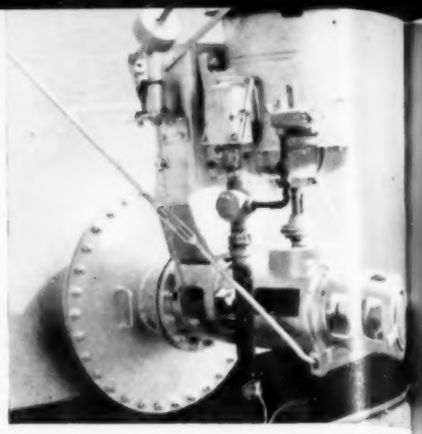
—34—Head Loss Charts for Various Sizes of Pipe

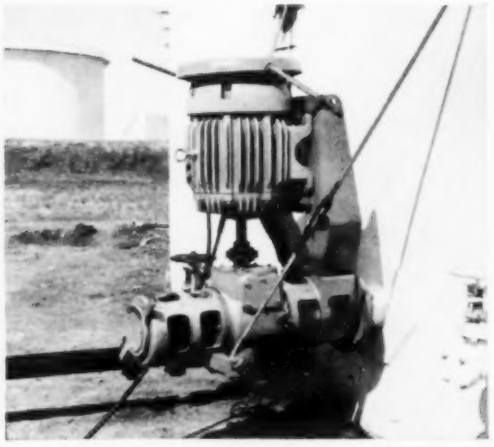
Friction Loss Characteristics for 8-inch pipe were computed by a pipe line company using data of the Hydraulic Institute. Use of this data in laminar and critical zones is adequate for estimates. Friction losses in Transition and Complete Turbulence Zones are very accurate.

(Chart 3 in a series of 19—8-inch line pipe.)

ENGINEERING DESIGN 34





YOU CAN GET LIGHTNIN MIXERS for controlling bottom sediment in any tank, regardless of capacity.

How 50 pipe line companies keep tank bottoms clean . . . **by pressing a switch**

More than 50 independent pipe line companies, and some 35 leading producers and refiners, have found an easy way to say good-bye to sludge cleanout costs in crude storage tanks.

Uniform crude; no sludge pile-up; dramatic savings—these are the results when you control sediment by flipping the switch on a LIGHTNIN Mixer.

Saved: $1,000 per tank per year

If your tank cleaning costs are about average, you lose from $5,000 to $8,000 every time you clean out an 80,000-barrel tank. These cost figures include a conservatively estimated $2,000 in marketable oil and wax lost in the bottoms. Often, this loss runs much higher—as high as $6,000 in some cases.*

When you install LIGHTNIN Mixers, you eliminate sludge buildup for good. You can keep sediment suspended in the crude, or resuspend it if it has settled. You can blend crude stocks to prevent stratification, and to dispatch a uniform crude.

Savings, overall, are on the order of $1,000 per tank per year.

As a bonus, you keep full holding capacity of your crude tanks ready for use when you need it. You gain as much as 12% more storage capacity —without adding a single tank.

Your LIGHTNIN Mixer representative can tell you how much *you'll* save with LIGHTNINs in your crude storage tanks. Look him up in Composite Catalog and call him in. Or write us direct.

*Based on field studies by a major pipe line company. Details on request.

Lightnin® Mixers

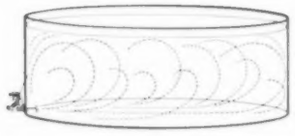
MIXCO fluid mixing specialists

Get these helpful bulletins on BS & W control and LIGHTNIN Mixers. Check, tear out and mail to us today with your name and company address. Free—no obligation.

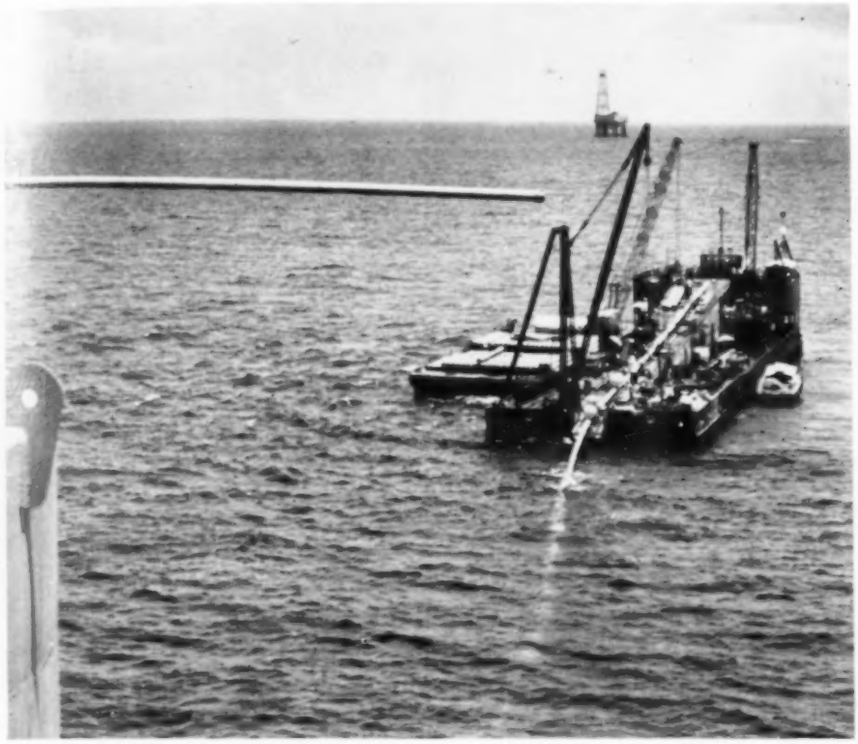
- ☐ B-503 BS & W Control with LIGHTNIN Mixers
- ☐ B-104 Side entering mixers, 1 to 25 HP
- ☐ B-107 Data sheet for figuring mixer requirements
- ☐ B-109 Condensed catalog describing LIGHTNIN Mixers —all types
- ☐ B-111 LIGHTNIN rotary mechanical seals for extra-low-cost mixing

MIXING EQUIPMENT Co., Inc., 196-j Mt. Read Blvd., Rochester 11, N.Y.

In Canada: Greey Mixing Equipment, Ltd., 100 Miranda Avenue, Toronto 10, Ont.



YOU CAN MAINTAIN bottom sediment level of as little as one inch, year after year, with LIGHTNIN Mixers in your tanks.



CATC Builds Offshore Line

Marine Gathering Company's pipe laying barge *Magic* heads for one of the CATC Offshore Group's self-contained platforms in the Gulf of Mexico. The barge is laying 25 miles of pipe line system for CATC. The line, which is scheduled for completion in early September, will transport both oil and gas from three self-contained platforms in the Grand Isle area to a point near Grand Isle, La. The *Magic* is the first vessel specifically designed and built for laying pipe line in the open waters of the Gulf of Mexico.

El Paso Natural Plans 500-Mile Idaho to California Gas Pipe Line

Plans to build a 500-mile pipe line to carry natural gas from Twin Falls, Idaho, southward to the California border near Las Vegas, Nev., have been announced by the El Paso Natural Gas Company.

The 34-inch line will carry Western Canadian natural gas bought at Twin Falls from Pacific Northwest Pipeline Corporation system. El Paso Natural will terminate its line at the California-Nevada border where it will link with lines of the Southern Counties Gas Company and Southern California Gas Company, both affiliates of Pacific Lighting Corporation. These facilities will be built to take the gas to Los Angeles markets.

It was reported that the southern California companies signed a contract with El Paso Natural for 200,000,000 cubic feet daily. Delivery of the first hundred million would start by September, 1959, and the balance by September, 1960. El Paso Natural will receive the supply through an agreement with Pacific Northwest, which is contracting for the Canadian gas.

Long range plans include El Paso Natural's willingness to furnish an additional 400 million cubic feet of natural gas daily in ensuing years when it is requested by the southern California companies.

The gas will travel a distance of about 2200 miles from sources in Canada to market in the Los Angeles basin. A little over 200 miles of the total distance will be from the California-Nevada border to Los Angeles.

El Paso Natural has pending before the Federal Power Commission an application to supply the two southern California companies an additional 75 million cubic feet of out-of-state gas daily. Thus, with the 200 million cubic feet of Canadian source gas covered by the new agreement, the southern part of the state will have a total out-of-state gas supply amounting to 1,230 million cubic feet of gas daily within three years time if the state and federal regulatory bodies approve the agreements.

El Paso's planned construction of the 500-mile line is subject to approval by the California Public Utilities Commission, the Federal Power Commission as well as Canadian governmental agencies.

The project could be affected by recent court action in the form of a government antitrust suit filed last month to break up the El Paso Natural and Pacific Northwest merger. The merger had made El Paso Natural the world's largest transmission company but the Justice Department has charged that it contains evidences of monopoly in the supply of gas west of the Rocky Mountains.

Oil Dealers' Protest Delays Joint Gas Line Construction

A group of Florida oil dealers are seeking to delay construction on the joint gas line planned by Coastal Transmission Corporation and Houston Texas Gas & Oil Company. The line has been approved by the Federal Power Commission and construction had been planned to start this fall.

The petition by 119 Florida oil dealers, Florida Economic Advisory Council, are attempting to have the line's FPC authorization withdrawn and the case remanded to the FPC for further hearings. According to one report, construction will be postponed until the petition for rehearing is acted upon.

The oil dealers object to the interstate line on the grounds that the council was not given a fair hearing by the commission. The brief cited a number of alleged errors in the FPC approval. Reply briefs by FPC, pipe lines and Florida power companies are due September 10. The court will hear oral argument about one month later.

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Four Corners Line Awards Three Additional Contracts

Additional contract awards for construction of the rapidly-progressing Four Corners Pipe Line have been announced.

A. P. V. Company, Inc., and R. B. Potashnick of Cape Girardeau, Missouri, jointly will build the 104-mile section of 16-inch trunk line between Seligman, Arizona, and the Colorado River to the west.

Pacific Pipeline Company has been given the contract to construct 46 miles of 16-inch line from Olive, California, into Los Angeles.

Standard Pipeline Construction Company will build the feeder lines to connect various fields in Utah and New Mexico.

Previously let were contracts for 485 miles of 16-inch and 86 miles of 12-inch line. Construction is currently under way on all of these sections except those lying across the desert areas of California.

The line, which will carry crude from oil fields in the Four Corners area to refineries near Los Angeles, is proceeding ahead of schedule, with completion now planned for January of 1958. Design changes will give the line an initial capacity of 70,000 barrels daily rather than 60,000 as announced previously. More than 135 miles of 16-inch trunk line is now completed.

Still to be let are contracts for the crossing of the Colorado River; three pump stations, at Red Mesa, Utah, Cameron, Arizona, and Twenty-nine Palms, California, and two pressure reducing stations, at Kingman, Arizona, and Corona, California.

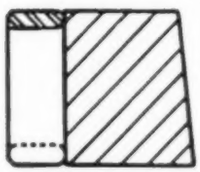
Two Contractors Awarded Texas-New Mexico Co. Line

Texas-New Mexico Pipe Line Company has awarded contracts for the construction of its Aneth, Utah, to Jal, New Mexico, 16-inch pipe line.

Four Way Company, Inc., of Azte New Mexico, was awarded the first section which starts in the Aneth field and consists of 150 miles. Panama Inc., with headquarters in Houston Texas, was selected to construct the second section consisting of 173 miles and the third section consisting of 189 miles.

PEDRICK pioneered Conformable rings for big-bore engines

U.S. Patent No. 2,771,329



TF7 DESIGN

This design is recommended especially for 4-cycle engines

Here's Pedrick's Conformable
TAPER-FACE COMPRESSION Ring

The big feature of the TF7 taper-face compression ring is its conformability under all kinds of cylinder conditions. Because of PEDRICK'S exclusive "Equalizer," which exerts a positive and uniform pressure outward at every point around the ring circumference, the cast-iron section is radially thinner, and therefore more flexible.

The taper-face of this conformable compression ring provides a line contact with the cylinder wall for higher unit pressure, quicker seating and sealing and less chance of scuffing.

The TF7 ring is one of numerous modern designs used by PEDRICK engineers to *precisioneer* the very best combination of rings for maximum results in each particular installation. Take advantage of our Engineering and Consulting Service to help solve your ring problems. Write, wire or phone: WILKENING MANUFACTURING CO., Philadelphia 42, Pa. SAratoga 9-3770. In Canada: Wilkening Manufacturing Co. (Canada) Ltd., Toronto 2.

Pedrick® PISTON RINGS

Three U. S. Construction Companies Get $200 Million Argentine Contract

Fish Engineering Corporation, Fish-Northwest Constructors, Inc., and North American Utility and Construction Company have received a $200 million pipe line construction contract from Argentina's oil monopoly, Yacimientos Petroliferos Fiscales.

The Argentine government had issued a decree empowering the YPF to sign the contract with the three United States firms. According to a report, North American Utility and Construction Company will primarily be involved in the financial aspects of the contract.

The signed contract calls for construction of the two longest pipe lines in the country. They include an 815-mile, 24-inch line from the Campo Duran fields on the Bolivian border to bring natural gas south to Buenos Aires, and a 12-inch line from Campo Duran to bring crude oil to a YPF refinery near Rosario. The latter location is 250 miles northwest of Buenos Aires.

The government announcement from Buenos Aires stated that the work contracted was urgent to assure a greater flow of gas and oil from the state operated fields of Salta Province to the area near Buenos Aires and Rosario. Lack of transportation facilities in the past has forced Argentina to make imports in order to fill a large part of the country's oil needs.

This construction program has been planned for several years but had experienced repeated delays due to politics and financing. A third pipe line is planned but was not included in the contract letting. New bids may be asked on this 625-mile, 12-inch crude line from Mendoza to San Lorenzo.

Dependability

an important consideration when you select a Pipe Line Contractor

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GENERAL CONTRACTORS
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Magnolia Lets Contracts On Midland-Beaumont Line

Magnolia Pipeline Company has let contracts to expand its 12-inch Midland to Beaumont, Texas, crude line. O. R. Burden Construction Corporation and H. B. Zachry Company have been awarded the construction contracts to boost capacity of the line by 75,000 barrels per day.

O. R. Burden will start the looping program this fall by laying 120 miles of 16-inch line and 4 miles of 12-inch westward from Clyde, just east of Abilene, to Midland. H. B. Zachry will lay 24 miles of 20-inch, 83 miles of 16-inch and 20 miles of 12-inch between Clyde and Corsicana.

H. B. Zachry expects to complete by November 1. Completion date is December 31 for O. R. Burden.

Industrial Education Group To Hold Drafting Seminars

The Industrial Education Institute, in cooperation with leading professional societies, trade associations and industrial publications, will sponsor a series of one day seminars on advanced techniques in functional drafting.

The seminar will open in Cleveland on September 24, New York on October 2 and will tentatively conclude in Baltimore and Chicago on October 29 and 31, respectively.

Applications and additional information can be obtained from the Industrial Education Institute, 25 Huntington Avenue, Boston 16, Mass.

OIL AND GAS TRANSMISSION LINES

Youngstown electric weld line pipe provides safe passage for oil and gas through America's important transmission lines

Pipe lines that transport gas and oil to our metropolitan consumption centers are most vital to America's future. Because these important carriers must give dependable around-the-clock service all-year-long, leading Pipeliners specify Youngstown Pipe for its: Easy bending, uniform wall thickness, excellent line-up characteristics, outstanding weldability and longer lengths. Thus, lines are laid faster and easier.

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Federal Power Commission Approves Three Pipe Line Construction Requests

The Federal Power Commission has recently given approval to three pipe line firms for construction of natural gas facilities costing approximately $10.6 million.

Mississippi River Fuel Corporation was authorized to build 6,400 additional horsepower in existing compressor stations and 54 miles of 26-inch pipe line paralleling sections of its existing system in Louisiana, Missouri and Arkansas. The company was also authorized to construct additional field facilities in Louisiana to deliver natural gas to Texas Gas Transmission Corporation, of Owensboro, Ky., for redelivery to Mississippi near Perryville, La. The estimated cost is $6,936,600.

Michigan Wisconsin Pipe Line Company was given approval to construct and operate 22 miles of 24-inch loop pipe line in Illinois and Wisconsin at an estimated cost of $1,823,000. The construction of the two 11-mile segments will result in the complete looping of its main line serving Wisconsin. No additional service is contemplated by means of the additional facilities.

Northern Natural Gas Company will construct an estimated total of $1,923,100 of natural gas facilities in Hansford County, Texas. The construction includes 12.7 miles of 16-inch line to replace an existing 10-inch line, certain additional field line and measuring facilities and boosting the capacity of its Spearman dehydration facilities. The 10-inch line and about 14 miles of gathering lines will be removed with the company expecting to obtain about $330,300 from the salvage.

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La Gloria Stockholders Accept Texas Eastern Offer

The acquisition of La Gloria Oil and Gas Company as a subsidiary of Texas Eastern Transmission Corporation was assured recently when Texas Eastern's share-for-share exchange offer was accepted by holders of substantially more than 81 percent of the outstanding La Gloria common.

The offer which was made last month proposed the exchange of one share of Texas Eastern common for each share of La Gloria common. It was contingent upon acceptance by holders of 810,000 of La Gloria's one million outstanding shares.

The newly acquired company with headquarters in Corpus Christi will be operated as a subsidiary of Texas Eastern with the same management and personnel.

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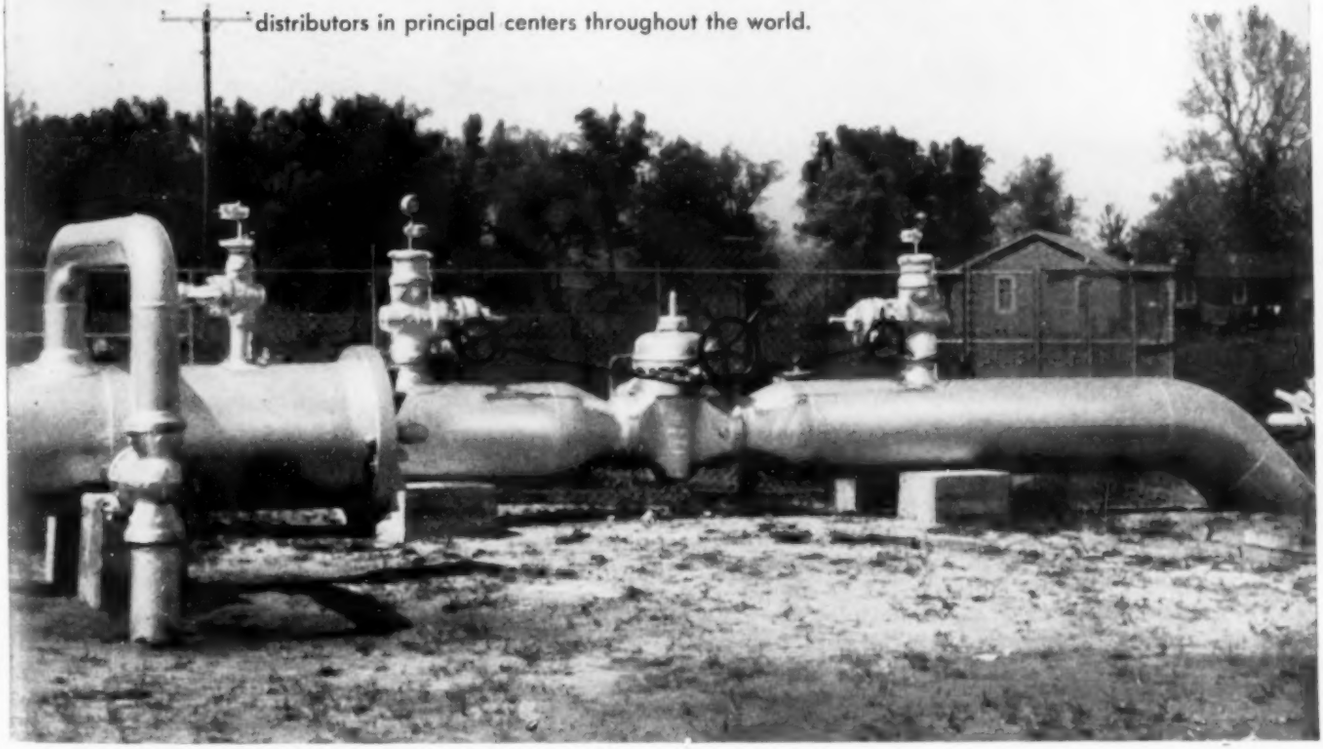

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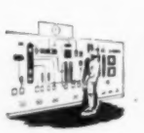

Graphic Panels, Control Centers

Panalog Information Systems

Panellit Service Corporation

Mexican Gas Begins Flowing Into U. S. Via Texas Eastern

Large quantities of Mexican gas began flowing into the United States for the first time recently when special ceremonies marked the completed connection of Texas Eastern Transmission Corporation's Vidor-to-McAllen, Texas, natural gas line with Petroleos Mexicanos facilities near Reynosa, Mexico.

Initially some 115,000,000 cubic feet of natural gas will flow across the international border into the U. S. each day. This gas will be transmitted through Texas Eastern's 5,900-mile natural gas system that extends through the central U. S. and terminates on the eastern seaboard near New York.

Eight Companies to Build Wisconsin Petroleum Terminal

Eight participating companies plan to build a major bulk petroleum distribution center consisting of four products terminals in northwestern Wisconsin near Cadott.

Also included in the plans is a 93-mile pipe line from the Twin Cities of Minneapolis and St. Paul, Minnesota. Great Lakes Pipe Line Company will build the 50,000 barrels per day capacity pipe line. The area is now supplied by truck from Minneapolis and St. Paul terminals.

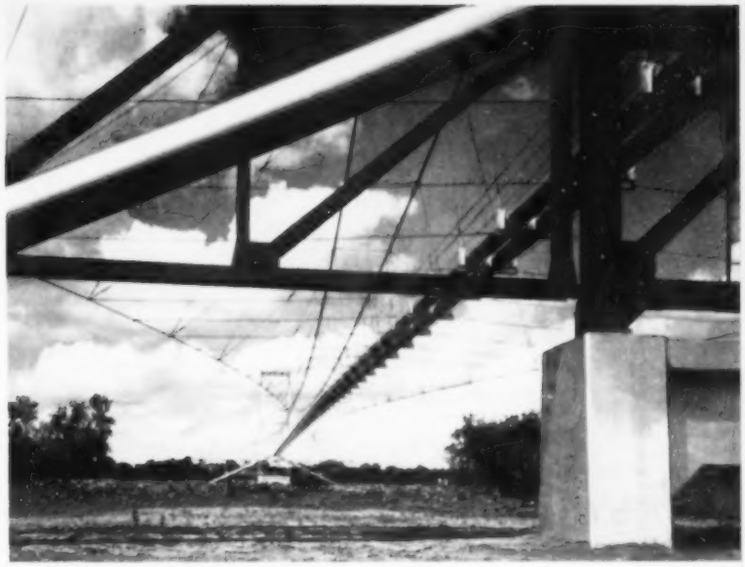
Cost of the entire project is $7,500,000. Phillips Petroleum Company, Continental Oil Company, Skelly Oil Company and DX-Sunray Oil Company will operate a 10-million gallon terminal jointly. It will adjoin terminals operated separately by Midland Co-Operatives, Inc., Farmers Union Oil Company and Cities Service Oil Company.

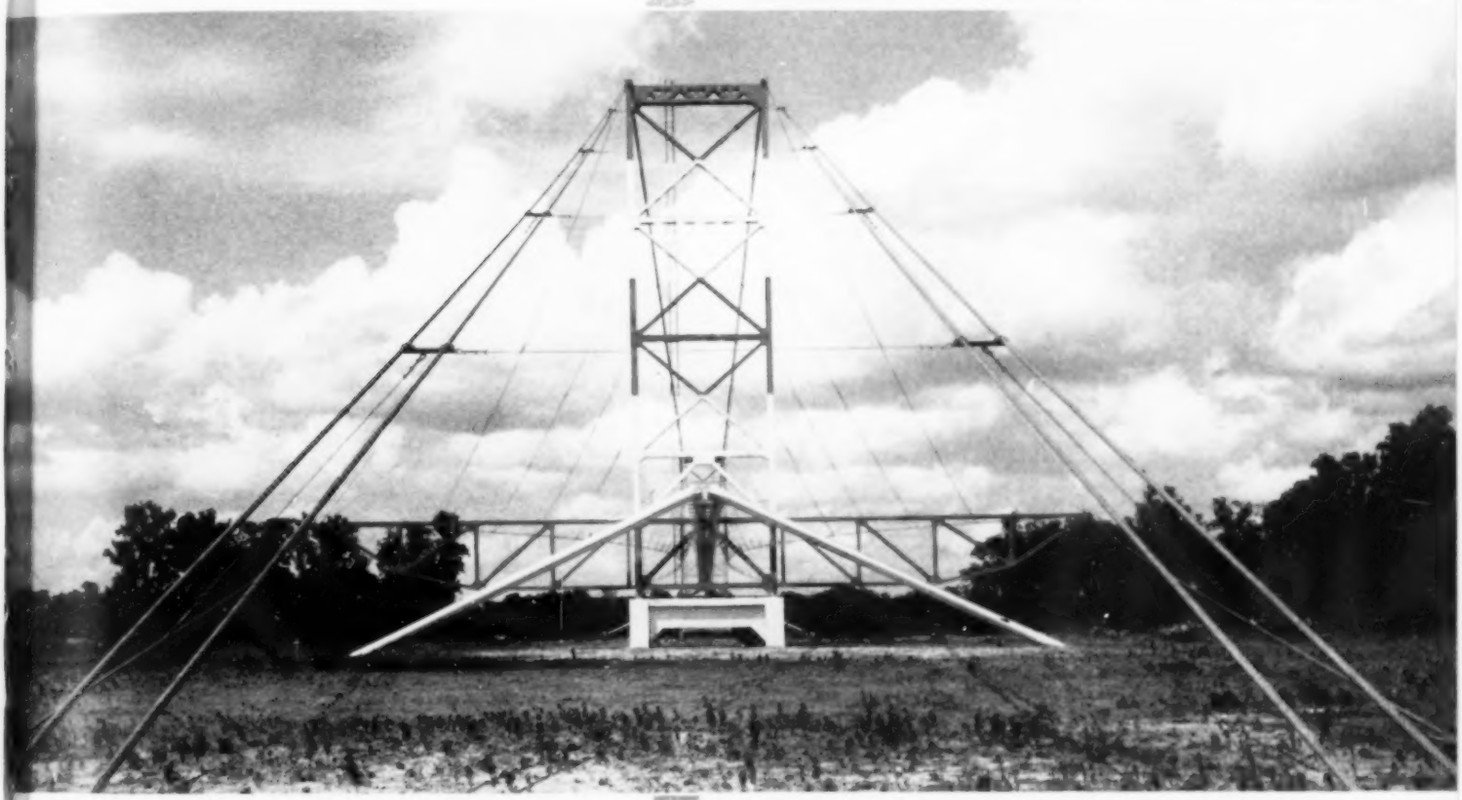
Creole Lays Aluminum Pipe in Lake Maracaibo

The floor of Lake Maracaibo in Venezuela will be crisscrossed with more oil-carrying aluminum pipe according to the Creole Petroleum Corporation. Twenty-two miles of the new lines, anchored in water up to 90 feet in depth, will transport crude oil from offshore wells to offshore flow stations.

Creole first installed the aluminum pipe in Lake Maracaibo in 1955.

safe hurdle for high water





Brazos River Crossing, in South Texas. Single main span 960 ft long carries two 30" diameter pipes. Designed by Matthews and Kenan.

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PROPOSED PIPE LINE CONSTRUCTION

Here in convenient summary form is Pipe Line Industry's listing of company, line size, length, service, location and project status.

U. S.

Cape Pipe Line Co., Philadelphia, 100 miles, large diameter, Delaware Bay to the Philadelphia refining area, planned.

Chicago District Pipeline Company, 52 miles, 30-36 inch, gas, from Natural Gas' proposed line at Joliet to Chicago, $13 million, before FPC.

Cities Service Gas Co., Oklahoma City, 116 miles, gas, facilities in Kansas and Oklahoma and pipe lines in Kansas, $11.4 million, authorized.

Coastal States Gas Producing Co., Corpus Christi, Texas, 45-mile, gas gathering system in Bee County, Texas to connect with Texas Eastern's main pipe line, $1 million, planned.

Coastal Transmission Corp., Houston, 574 miles, 22-26 inch, gas, from McAllen, Texas to Baton Rouge, La. connection of Houston, Texas Gas and Oil plus 414 miles of laterals, $55 million, authorized.

Colorado Interstate Gas Co., Colorado Springs, 734 miles, 24-30 inch, gas, from Texas & Okla. Panhandle to Kit Carson, Colo., to Beatrice, Neb., plus four compressor stations, $120 million, before FPC.

Deep Rock Gas Co., Oklahoma City, 120 miles, 6-inch, LPG, from Tioga, N. C., to Canadian border, planned.

El Paso Natural Gas Co., El Paso 1141 miles, 6-34 inch, field and main lines, gas, facilities in Texas, New Mexico and Arizona to deliver gas to Southern Calif. Gas Co., Southern Counties Gas Co., and Pacific Gas & Electric Co., $162 million, 290 miles authorized.

230 miles, 5-6 inch, products from Odessa, Texas to the El Paso area, planned.

500 miles, 34 inch, gas from Twin Falls, Idaho to California border near Las Vegas, Nev., planned.

El Paso Natural Gas Products Co., 240 miles, 8 inch, products, from Midkiff natural gasoline plant in Permian Basin to El Paso, planned.

Four Corners Pipe Line Co., Houston, 600 miles, 16 inch, crude, from Four Corners area to Los Angeles plus 150 miles of feeder lines, $50 million, contracts let on 635 miles to A. P. Vaughn Construction Co., R. H. Fulton Construction Co., Potashnick Construction Co., Pacific Pipeline Co. and Standard Pipeline Construction Co.

Great Lakes Pipe Line Co., Kansas City, Mo., 140 miles, 8 inch, products, from company's terminal at Minneapolis to terminals at Superior, Wis., contract let to Laco Pipeline Contractors, Inc.

93 miles, products, from Minneapolis and St. Paul to petroleum terminal in northwestern Wisconsin, planned.

Gulf Interstate Gas Co., Houston, additional compressor facilities in Kentucky, Tennessee, Mississippi, and Louisiana, and 10 miles of gathering lines from Erath field, gas, $24.5 million, temporary authorization.

Harry Bass & Sons, Inc., Dallas, pipe line network from well heads to compressor stations to central gasoline plant plus line to railroad in Pembina field, Alberta, $17 million, approved.

Houston Texas Gas & Oil Corp., 942 miles, 18-24 inch, gas, Baton Rouge, La., to Miami, plus 682 miles of laterals in Florida and compressor stations, $95 million, authorized.

Humble Oil & Refining Co., 200 miles, main gathering system line of varying sizes, 250 miles, 26 or 30 inch main carrier, gas, from southwest Texas to Houston, plus gas processing and cycling plant near Corpus Christi, $75 million, planned.

Iron Ranges Natural Gas Co., 115 miles, gas, from Itasca and St. Louis counties along route of Mesabi range from Grand Rapids to Aurora, Minn., $5 million, before FPC.

Laurel Pipe Line Co., Philadelphia, 440 miles, 14-24 inch, products, from Philadelphia to Pittsburgh to Cleveland, $50 million, planned.

Magna Pipeline Co., 40 miles, gas, underwater line from Anacortes, Wash., to Victoria, B. C., $6 million, planned.

Magnolia Pipeline Co., Dallas, 247 miles, 12-20 inch, crude, from Midland to Clyde and Corsicana, Texas, contract to H. B. Zachry Co. and O. R. Burden Construction Corp.

Michigan-Wisconsin Pipe Line Co., Detroit, 472 miles, 4, 24-inch, gas, main line loops and extensions in Wisconsin, Illinois, $17.6 million, before FPC, temporary authorization for a part, 47.5 miles let to G. E. T. Construction, Inc.

Midwestern Gas Transmission Co., Houston, 2067 miles, 3-24 inch, gas, from Emerson, Manitoba, to Nashville, Tenn., $103 million, before FPC.

Mississippi River Fuel Corporation, 54 miles, 26 inch, gas, paralleling sections of existing system in Louisiana, Missouri and Arkansas plus station facilities, $7 million, contract let to Cape Construction Co., Inc.

Natural Gas Pipe Line Co. of America, Chicago, 25 miles, gas, from Quinduno field in Roberts County, Texas, $3.2 million, authorized.

416 miles, 30 inch, gas, loops at various points along existing line, $ 6.2 million, before FPC.

396 miles, 30 inch, gas, loop line between company's terminus in Texas and Beatrice, Neb. and Joliet, Ill., $62.7 million, before FPC.

North Carolina Natural Gas Corp., 130 miles, 2-16 inch, from Transco's system near Mooresville across to southeastern North Carolina, planned.

Northern Natural Gas Co., Omaha, 167 miles, 20 inch, gas, from Farmington, Minn. to Duluth, Minn., and Superior, Wis., $12 million, before FPC.

42 miles, 10 inch, gas, from Rochester, Minn. to Winona and Goodview, Minn., $963,000, before FPC.

365 miles, gas, new facilities in Minn., Iowa, S. D., Neb., Wis., plus 1090 miles of branch line and station facilities, $65.7 million, authorization for a part.

Northwest Pipeline Corp., Salt Lake City, 350 miles, 6-10 inch, crude and products, Four Corners area to Salt Lake City, $15 million, planned.

Ohio Fuel Gas Co., Columbus, Ohio, 56 miles, 18-24 inch, Richland County, Seneca County, Sandusky County to Toledo area, $4 million, contract for 22 miles awarded to H. L. Gentry Construction Co.

Ohio Oil Company, Findlay, Ohio, 350 miles, 12 inch, products, from Wood River, Ill. to Chicago, 84 miles let to Panama-Williams Corp.

85 miles, products, from Ohio's refinery in Robinson, Ill. to Champaign, Ill., approved.

Oil Field Pipeline, Inc., Wichita, Kansas, 255 miles, 8-12 inch, crude, from southwest corner of Kansas to Rice County, Kansas, planned.

Pacific Gas & Electric Co., 1,300 miles, gas transmission, Alberta, Canada to Antioch, Calif., $380 million, planned.

Pacific Northwest Pipe Line Corp., Salt Lake City, 1000 miles, gas, gathering system in San Juan Basin and sales laterals in Washington plus compressor facilities, $30 million, planned.

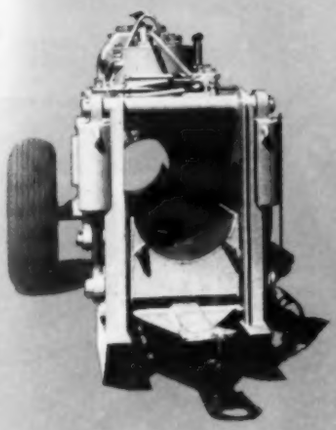
112 miles, gas, laterals, in Washington and Idaho, $3.5 million, authorized.

Pennsylvania Gas Co., Warren, Penn., 38 miles, 8, 10 inch, gas, in Erie and Warren Counties, Penn., and Chautauqua County, N. Y., $2.6 million, authorized.

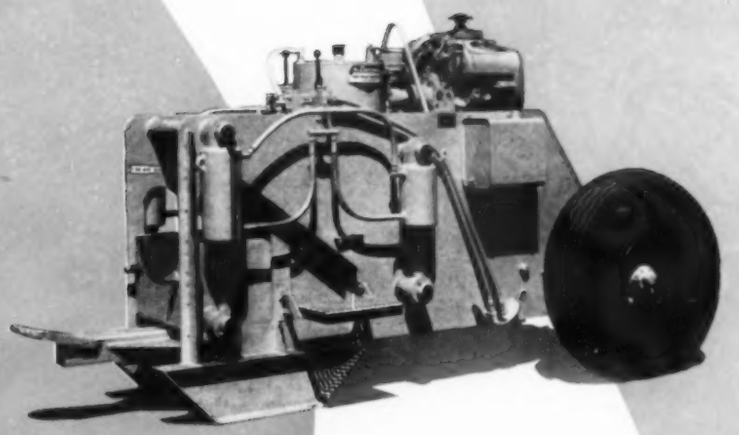
Piedmont Gas Co., Hickory, N. C., 78 miles, 2-8 inch, gas, from connection

Continued on Page 77

YOU CAN'T BEAT A CINCH



NEW CINCH VERTICAL MACHINE BENDS 6″-20″ PIPE MORE EASILY AND ECONOMICALLY



• MOVES ANYWHERE — overall width only 6′8″, mounted on toughest rubber tires • LIGHTWEIGHT — approx. 8400 lbs. complete with bending set • SIMPLE HYDRAULIC OPERATION — broken cable and other mechanical shutdowns eliminated, extra smooth bending power • SCRATCH-FREE, DEGREE-CONTROLLED BENDS — made closer to end of joint.

This new Cinch pipe bending machine already is in operation from coast to coast. Its hydraulic action gives it the extra power to bend quickly and smoothly ½-inch wall pipe up to 20″ in diameter. Its light weight, compactness, bending power and simplicity are unmatched.

Crose offers two additional Cinch models for bending pipe 16″-30″ and 22″-36″ in diameter.

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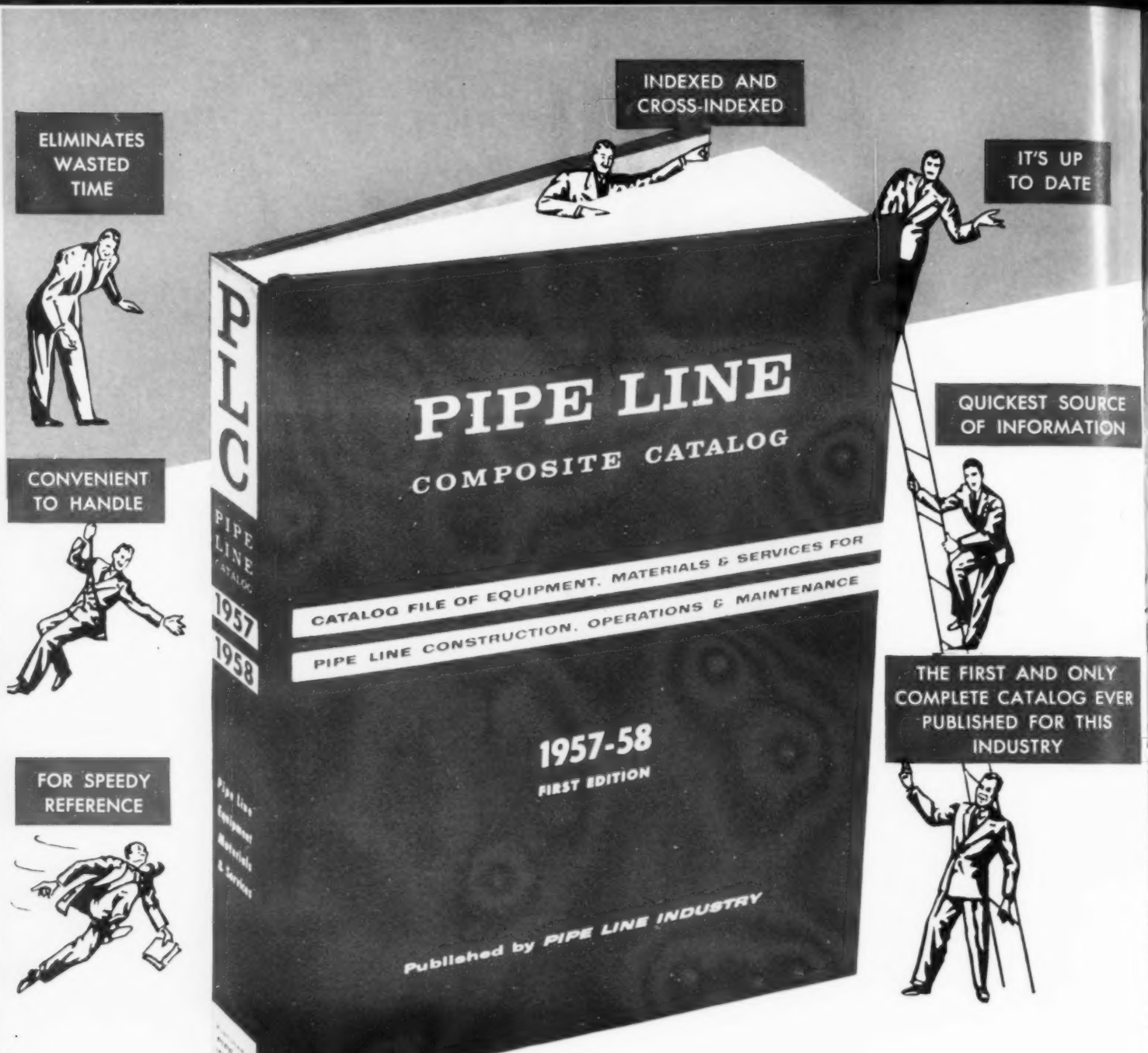

The first catalog data file ever published especially for the Pipe Line Business is now off the press. It is serving as a genuine time saver for operating and field executives, superintendents, foremen, engineers, purchasing agents and many others who buy or specify equipment and materials.

Almost 150 leading companies have filed their complete or condensed catalogs in this useful first edition. Compiled by the manufacturers themselves, this information is arranged and indexed to offer a quick and convenient means of locating *what you want when you want it.*

If furnished to you in individual brochures, bulletins or specification sheets, the information that is now condensed into this composite catalog file would fill the equivalent of several file drawers or book shelves.

On the opposite page you'll find a complete list of the companies that have filed data in the new, specialized Pipe Line Composite Catalog. When you are looking for sales information, be sure to check these companies in your Pipe Line Composite Catalog. It is the most complete source of buying information available in one volume for this industry today.

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Alco Products, Inc.
Aldrich Pump Co.
Allied Chemical & Dye Corp., Barrett Division
Allis-Chalmers
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Bramble Industries, Gulf States Asphalt Co. Division
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Caterpillar Tractor Co.
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Central Plastics Co.
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Coffing Hoist Division, Duff-Norton Co.
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Cook Bros. Equipment Co.
C. Lee Cook Co., Division of Dover Corp.
Corrosion Rectifying Co., Inc.
G. A. Cotten Co.
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Dover Corp., C. Lee Cook Co. Division
Dresser Industries, Clark Bros. Co. Division
Magnet Cove Barium Corp. Division
Drive-Thru Gate Co.
Duff-Norton Co., Coffing Hoist Division
Dutch Brand Division, Johns-Manville Corp.

Allan Edwards, Inc.
Elliott Co., Ridgway Division
Embart Manufacturing Co., The Maxim Silencer Co. Subsidiary
Engineering Research Corp.

Falk Corp.
Farrel-Birmingham Co., Inc.
Federal Telephone and Radio Co., Division of International Telephone and Telegraph Corp.
Fish Engineering Corp.
Flexitallic Gasket Co.
Fluor Products Co., Division of Fluor Corp., Ltd.

Gardner-Denver Co.
Gaso Pump & Burner Mfg. Co.
Gearench Mfg. Co.

These leading manufacturers, suppliers and service companies have filed complete or condensed catalog data in the first (1957) edition of the new PIPE LINE COMPOSITE CATALOG. See their detailed information in the catalog when you are ready to buy.

General Electric Co.
The Gorman-Rupp Co.
Granberg Corp.
Greenhead Sling and Supply Co.
Greenwood Valve Division, Vernon Tool Co., Ltd.
Grove Valve and Regulator Co.
The Gulf Publishing Co. (Pipe Line Forms)
Gulf States Asphalt Co., Division of Bramble Industries

H & L Tooth Co.
H & M Pipe Beveling Machine Co.
Hamer Valves Inc.
Hammond Iron Works
Haynes Manufacturing Co.
Hercules Motors Corp.
Holcombe Co., Inc.
Homelite, Division of Textron Inc.
Houston Equipment Co., Inc., Division of Houston Foundry & Machine Co.
Hudson Engineering Corp.
Humble Oil & Refining Co.
Hydril Co.

Ingersoll-Rand Co.
International Telephone and Telegraph Corp., Federal Telephone and Radio Co. Division

Jefferson Chemical Co., Subsidiary of American Cyanamid Co.
Johns-Manville Corp., Dutch Brand Div.

King Tool Co., Ltd.
Kinzbach Tool Co., Inc.

L & M Company
L-K Pump Valve Co.
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Lubrikup Co., Inc.
Lufkin Foundry & Machine Co.

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Mercoid Corp.
Midwestern Pipe Line Products Co.
Mine Safety Appliances Co.
Mixing Equipment Co., Inc.
Modern Motors Sales & Service
Morris-Young-Owens Co.
Mountain States Asphalt Co., Division of Bramble Industries
Multiple Corp.
Frank W. Murphy, Manufacturer, Inc.

National Cylinder Gas Co., Tube Turns Division
National Tank Co.
Naylor Pipe Co.
Nickles Machine Corp.

Oliver Tyrone Corp., Berry Hydraulics
Oil Well Supply Division, United States Steel Corp.

Panellit, Inc.
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Penberthy Manufacturing Co., Division of Buffalo-Eclipse Corp.
Perrault Equipment Co.
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Pipe Line Development Co.
Pipelife Corp.
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PIPE LINE COMPOSITE CATALOG

Published by PIPE LINE INDUSTRY

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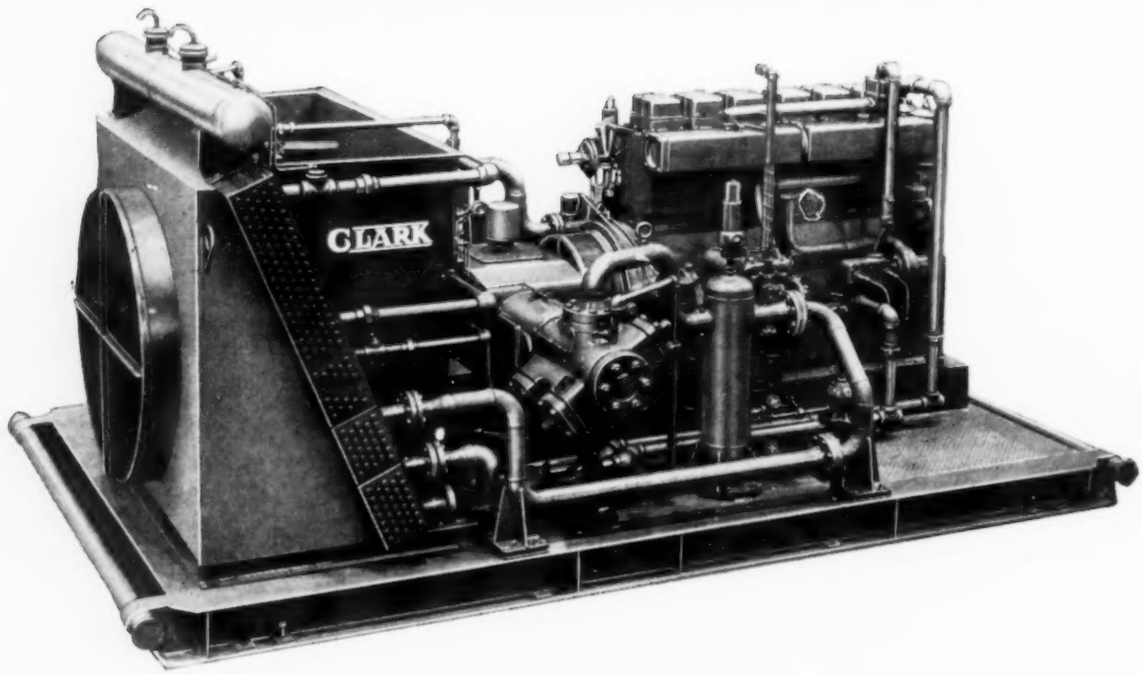

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One of the simplest ways to take the bugs out of packaged field compressors is to direct-couple the compressor to the engine. Clark engineers did exactly that when they designed the new CFA. Troublesome, power-robbing belts and gears between the engine and the compressor are not required. A simple rubber block coupling takes their place. But this achievement was made possible only because the CFA is so perfectly balanced and therefore can operate at a modern 1,000 rpm. without a quiver or a shake. Furthermore, the CFA is typically Clark. It has the built-in stamina and precision of its big brothers. You'll deplete the field, but you won't wear out the Clark compressor.

There are two and four cylinder CFA models available in the 100-350 bhp. range. Your nearest Clark representative has all the facts and can tell you of other operators' experiences with the CFA.

CLARK BROS. CO. **OLEAN, N. Y.**

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CLARK **Packaged Field Compressors**

with Transcontinental Gas Pipe Line to serve customers in North Carolina, $2.6 million, before FPC.

Southern Kansas Pipe Line Co., Inc., 200 miles, 6-10 inch, crude, southwestern Kansas to Arkansas City, Kansas, planned.

Southern Natural Gas Co., Birmingham, 60 miles, gas, to connect transmission system to reserves in Plaquemines, St. Bernard and Jefferson parishes, La., and waters adjoining, plus compressor, meter and regulating facilities, $8 million, authorized.

Tennessee Gas Transmission Co., Houston, 633 miles, 30 and 24 inch, gas, from Louisiana delta to Portland, Tenn. and Coudersport, Pa. to Hamburg, N. Y., before FPC.

120 miles, 12, 20 and 26 inch, gas, Kinder, La. to offshore fields, authorized.

332 miles loop lines in Tennessee, Kentucky, West Virginia, Ohio, Pennsylvania and Mississippi, 68 miles authorized and contracts let to Harford Brothers Pipe Line Contractors, Bechtel Corporation, Oklahoma Pipe Line Constructors, Pentzien, Inc. and Collins Construction Co., sub-contractor, and 264 miles, before FPC.

Compressor stations in Mississippi, Tennessee, New York, Pennsylvania and additions in Tennessee, Kentucky, Ohio and Pennsylvania, before FPC; $167 million total.

Texas Eastern Transmission Corp., Shreveport, La., 333 miles, 14 and 30 inch, gas, pipe line plus station facilities in Louisiana, Mississippi, Pennsylvania and New Jersey, $50 million, before FPC.

93 miles, 14 inch, gas, from Lebanon, Ind., to Kankakee, Ill. (center portion of original 230 mile line from Seymour, Ind., to Chicago), contract let to Latex Construction Co. of Georgia.

Texas Eastern Transmission Corporation and Wilcox Trend Gathering System, Inc., natural gas facilities, $4 million, authorized.

Texas-New Mexico Pipe Line Co., Houston, 515 miles, 16 inch, crude, extension from Jal, N. M. pump station to Four Corners, $6.4 million. Contracts let to Four Way Co., Inc., and Panama, Inc.

Transcontinental Gas Pipeline Corp., Houston, 388 miles, gas, loop lines and gathering laterals in Texas and Louisiana and compressor facilities in Louisiana, Alabama, Georgia, Texas, South Carolina, Maryland, North Carolina, Pennsylvania and Virginia, $53.7 million, before FPC, temporary authorization for a major part.

Trans-Western Pipe Line Co., gas transmission, Four Corners area to California, proposed.

Trust Pipe Line Co., Big Spring, Texas, 128 miles, 6 inch, products, from Abilene to Wichita Falls, Texas, $1.5 million, contract let to Holder Construction Co.

Underground Storage & Exploration, Upper Darby, Penn., 394 miles, 12-inch LPG, from Moundsville, W. Va. to Newark, N. J., $9 million, planned.

United Gas Pipe Line Co., Shreveport, 40 miles, 8 inch, gas, from Baldwin County, Ala. to Container Corp. of America plant, Brewton, Ala., $1.4 million, contract let to Slade and McElroy, Inc.

International

ACT Oils, Ltd., Montreal, 400 miles, crude, Dawson Creek, B. C., Bella Coola, B. C., planned.

Alaska-Yukon Refiners and Distributors, Ltd., Edmonton, Alta., 150 miles, products, serving Alaska and Yukon territory, $3.5 million, planned.

Andes Pipeline Corp., 500 miles, 12 inch, gas, from Villamontes, Bolivia, to Antofagasta, Chile, $30 million, planned.

Bolivian Gulf Oil Co., 201 miles, 8-10 inch, crude, from Sicasica, Bolivia, to Arica, Chile, $10.5 million, planned.

Canada Southern Petroleums, Ltd., Calgary, 400 miles, crude, from Peace River region of northeast British Columbia to Bella-Coola, planned.

Cie. de Recherche et d'Exploration de Petrole au Sahara, 530 miles, 16 inch, crude, Edjele field in Algeria to a port on Libyan coast, planned.

Consolidated Gathering Systems, Ltd., Calgary, 198 miles, crude, Sturgeon field to Edmonton, planned.

Compania de Petroles de Chile, 75 miles, 10 inch, products, from government refinery at Concon to Santiago, contract let to Williams Bros.

Entre Nazionali Idrocarburi, Rome, Italy, crude, from Qum field in Iran to the Mediterranean Sea, planned.

Hydrocarbons Pipeline, Ltd., Winnipeg, Manitoba, 880 miles, 6-8 inch products from Edmonton, Alta. to Winnipeg, $35 million, planned.

India Government, 850 miles, crude, 20 inch, from Nahorkatiya to Calcutta, proposed.

Iraq Joint Venture Pipe Line, 1200 miles, 38-40 inch, crude, from head of Persian Gulf through Iraq to Turkish coast of Mediterranean, $840 million, planned.

Iranian Consortium, 26 inch, crude, from Gach Saran field to proposed terminal near Bandar Mashur, planned.

16 inch, crude, from Agha Jari field to Bandar Mashur, planned.

Mene Grande Oil Co., 42 miles, 16 inch, crude, from Ceuta field in Lake Maracaibo to Bachaquero terminal, $6 million, planned.

National Iranian Petroleum Co., 146 miles, 6 inch, crude, from Azna to Isfahan, Iran, $5 million, planned.

Northern Ontario Pipe Line Crown Corp., 311 miles, 30 inch, gas, from Manitoba-Ontario border to near Port Arthur, plus three river crossings on Winnipeg, Eagle and Kaministiquia Rivers, contracts let to Dutton-Williams Brothers, Ltd., Morrison-Shivers, Ltd., Majestic Contractors, Ltd., Houston Contracting Co. and River Construction Corp., Ltd.

Paraguay and Bolivia Governments, 500 miles, 6⅝ inch, crude, from Villa Montes, Bolivia, across the Chaco, to the Paraguay River, later to Asuncion, $12.7 million, contract let to Five Lilles, French firm.

Petroargentina, Bahia Blanca, Argentina, 370 miles, 16 inch, crude, from Newguen to Bahia Blanca, Argentina, $40 million, planned.

Petroleos Mexicanos, 150 miles, 14 inch, gas, from J. Colomo field to Minatitlan, $5 million, planned.

80 miles, 8 inch, products, from Guaymas to Los Mochis, $1 million, planned.

150 miles, 22-inch, gas, from Monterrey to Reynosa to tie into Texas Eastern system, planned.

Royal Dutch Oil Co., 155 miles, 24-30 inch, from German Rhineland to mouth of Rhine River, planned.

Royalite Oil Co., Calgary, 380 miles, crude, from Athabasca tar sand plant in northeastern Alberta to Edmonton, planned.

Saharian Pipe Line Co. (subsidiary of Cie. Francaise des Petroles, Algerie), 100 miles, 6 to 10 inch, from Hassi Messaoud field to Touggourt, Algeria, planned.

Saskatchewan Power Corp., Regina, Sask., 80 miles, gas, Hatton gas field to Success, Sask., planned.

40 miles, gas, Moose Jaw to Regina, Sask., planned.

Stanmount Pipe Line Co., 140 miles, 10 inch, crude, Cayiga and Beaver Lake fields, N. D., to connect with Interprovincial Pipe Line, planned.

Sturgeon Pipe Line Co., 100 miles, 12-inch, Sturgeon Lake field to Trans-Mountain system, $6.5 million, planned.

Sui Gas Transmission Co., Multan, Punjab, India, 145 miles, 8-inch, gas, from Sylhet to Dacca, East Pakistan, $9 million, considered.

Trans-Canada Pipe Line, Ltd., Calgary, Alta., 2250 miles 36 inch, gas, Alberta to eastern Canada, $378 million; most contracts let.

Trans-Europe Pipe Line, 500 miles, 30 inch, crude, from Mediterranean to northern Europe, considered.

Trans-Mountain Oil Pipe Line Co., 100 miles, loops near Kamloops, B. C. and Edson, Alta. plus pump station, tank farm and three temporary stations, $40 million, 50 miles let to Dutton-Williams Bros.

Westcoast Transmission Company, Ltd., Calgary, 270 miles, 8-26 inch, gas, various locations in Peace River region, contracts let for 155 miles.

174 miles, 30-inch, gas, Savanna Creek gas field, Alberta, to British Columbian border, planned, $45 million.

Winnipeg and Central Gas Co., Winnipeg, Mant., 450 miles, 4-8 inch, LPG, from Tioga, N. D. to Winnipeg, Canada, $20 million, planned.

Yacimientos Petroliferos Fiscales, Buenos Aires, Argentina, 1000 miles, 24-inch, gas, Campo Duran to Buenos Aires, Argentina and 12-inch, crude, from Campo Duran to refinery near Rosario, plus four compressor stations, $200 million. Contract let to Fish Engineering Corporation, Fish-Northwest Constructors, Inc. and North American Utility and Construction Co.

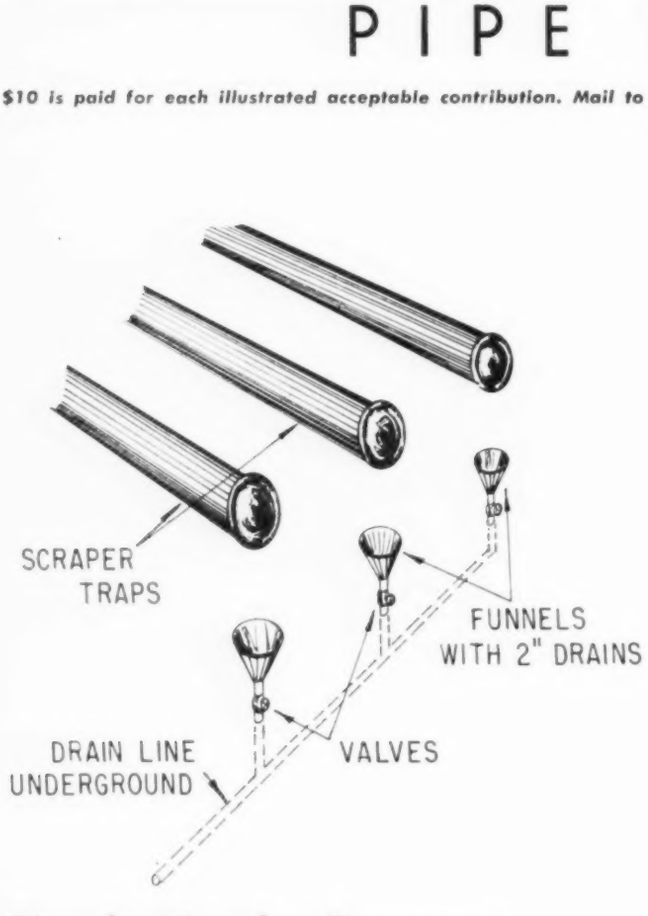
621 miles, 12-inch, products, Mendoza to San Lorenzo, Argentina, $19 million, planned.

281 miles, 12¾ inch, crude, Pichanal to San Miguel Tucuman, planned.

How to do it

PIPE LINE HINTS

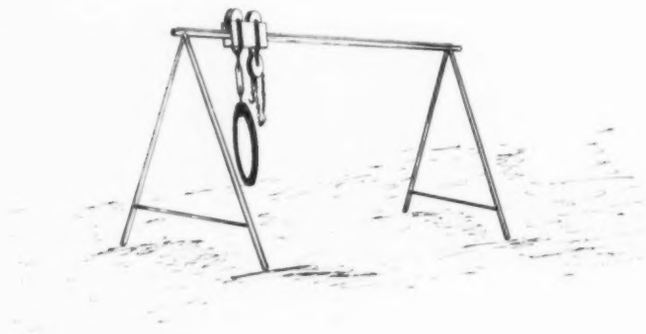
$10 is paid for each illustrated acceptable contribution. Mail to The Editor, PIPE LINE INDUSTRY, P. O. Box 2608, Houston 1, Texas

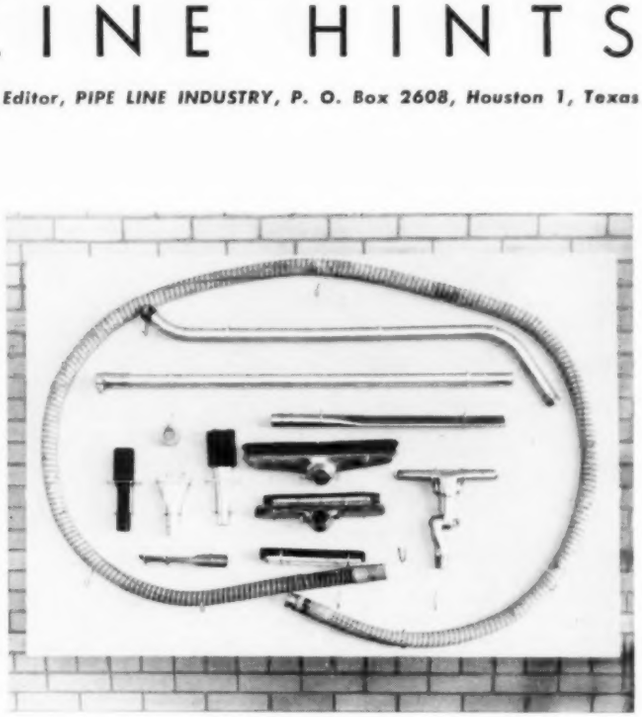


Simple Header Removes Scraper Trap Spillage

When either inserting or removing pipe line scrapers from a scraper trap, it is impossible to prevent spillage of the liquid that the suction pump does not take out of the traps before removing the flange.

This liquid, generally oil, can be disposed of quickly and efficiently by installing the simple header shown here. A funnel shaped bowl under each flange catches the spillage and empties it into a header consisting of two-inch pipe. Connecting this header to the station suction pump will allow easy disposal of the oil.





Plywood "Display" Board Aids Station Housekeeping

Here is a novel way to keep track of all vacuum cleaning fittings around a modern compressor station. Hose, nozzles and extension fittings are all hung on a plywood board fitted with wire hangers.

In this way cleaning tools are always handy and it is obvious at a glance if one of them is missing. An added benefit, it extends the life of the flexible vacuum hose by preventing abuse during storage.

Handy cleaning equipment is particularly important around electric or automatic stations where dust can damage relays and other electrical contacts. Appearance and improved maintenance are big bonuses.

Portable Traveling Crane Moves Heavy Loads Easily

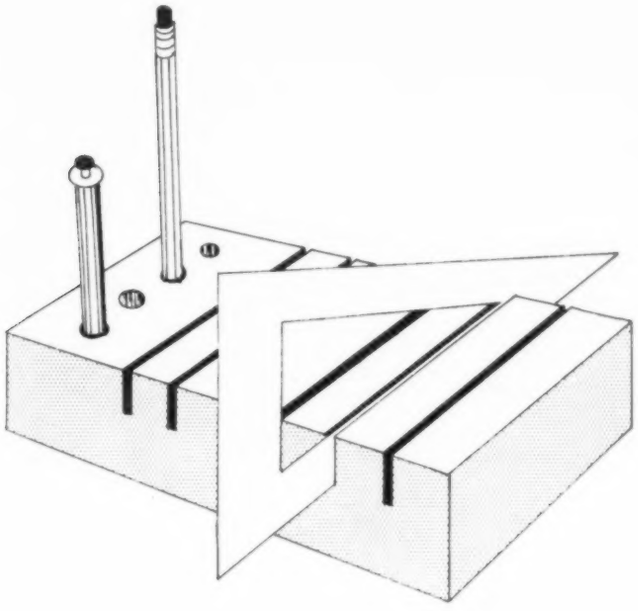
A portable traveling crane supported by extension legs permits one man to move easily and safely heavy loads that would ordinarily require two or three men. The crane is useful for periodic maintenance jobs where cylinder heads or other heavy parts must be removed, or for inserting large diameter scrapers into scraper traps.

The crane consists of a rail supported by two "A" frames with the block traveling along the rail and permitting the load to be moved easily by one man. Being portable, the crane is useful for locations away from permanent crane installations.

Self-Contained Work Bench Centers Tools, Saves Steps

This complete station work bench saves a lot of walking and looking for tools during routine maintenance chores at a compressor station. Casters and a tool board were added to a standard work bench.

All of the tools needed for ordinary jobs are handy and it is readily apparent if one is missing before work begins. A vise was also mounted at the right side of the bench for convenience. Additional storage is available behind the tool display board and on shelves beneath the bench. Larger wrenches, special overhaul tools and air powered equipment may be neatly stowed and moved to the job quickly.



Handy Wood Rack Holds Triangles and Pencils

The problem of loose triangles and pencils getting misplaced can be solved with the handy rack shown here. The rack consists of a 2-inch by 4-inch cut to any length desired. Slots are cut in the block as shown in the drawing to hold the required number of triangles. If desired, holes can be drilled in one end to hold pens and pencils. Using this handy rack will eliminate the shuffling of papers or drawings to find elusive triangles.

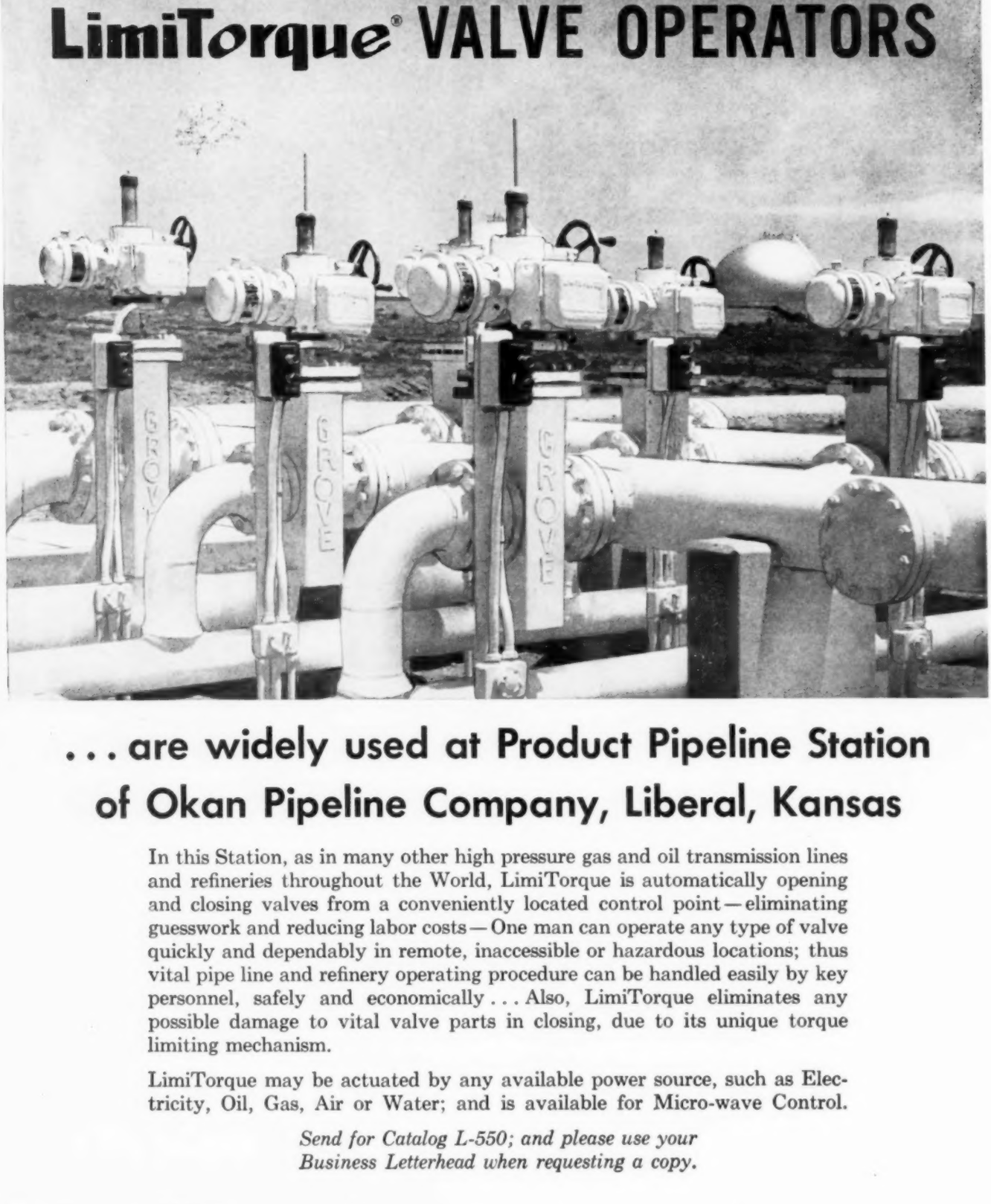
Wide-Angled Tripods Support Barricade Plank

A set of two simple tripods support the ends of a barricade board to bar traffic from roads, streets, alleys and highways while ditching and construction work is in progress. Made of scrap pipe, the tripods are simple and inexpensive to make.

Several of these portable barricade plank supports could be kept on hand at all times. The tripods and barricade boards are moved from place to place when and where they are needed.

With a relatively wide angle between the legs, the tripods are not easily upset or blown over.

LimiTorque® VALVE OPERATORS



. . . are widely used at Product Pipeline Station of Okan Pipeline Company, Liberal, Kansas

In this Station, as in many other high pressure gas and oil transmission lines and refineries throughout the World, LimiTorque is automatically opening and closing valves from a conveniently located control point—eliminating guesswork and reducing labor costs—One man can operate any type of valve quickly and dependably in remote, inaccessible or hazardous locations; thus vital pipe line and refinery operating procedure can be handled easily by key personnel, safely and economically . . . Also, LimiTorque eliminates any possible damage to vital valve parts in closing, due to its unique torque limiting mechanism.

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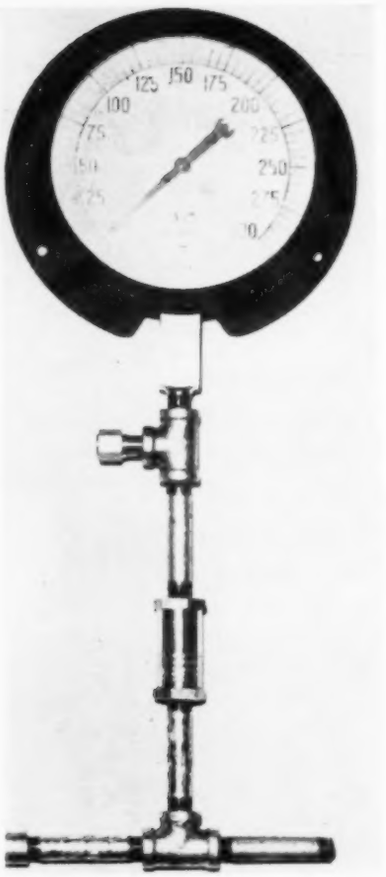

Relief Valve Checks System Pressure Gage

Have you ever lost the systems pressure because of a ruptured disc? To prevent this possibility, install in the gage circuit, a relief valve that will open to prevent pressures in excess of the gage's rating, and a check valve acting as an excess flow valve to block the gage off from system pressures. As the system pressure falls to a point within the gage's operating range, the protection arrangement opens to allow the gage to register system pressures automatically.

An additional safety feature of this system is to furnish protection in the event the Bourdon tube ruptures. The flow of fluid causes the check valve to close, thereby preventing the escape of gas or liquid.

Tank Stand Features Skids, Tool Storage

For field storage of fuel, this simple tank stand features skids for ease in handling and a rack for storing tools.

The skids are made from 3-inch pipe and the sides and floor from quarter-inch steel plate. Support plates are welded to the front, center and aft sections of the rack. These form two bins for tool storage.

A cradle for the tank is made by cutting out the center sections of the support plates and running a piece of 2-inch pipe along the sides. Straps are run over the top of the tank to hold it in place and to allow quick removal of the tank if necessary.

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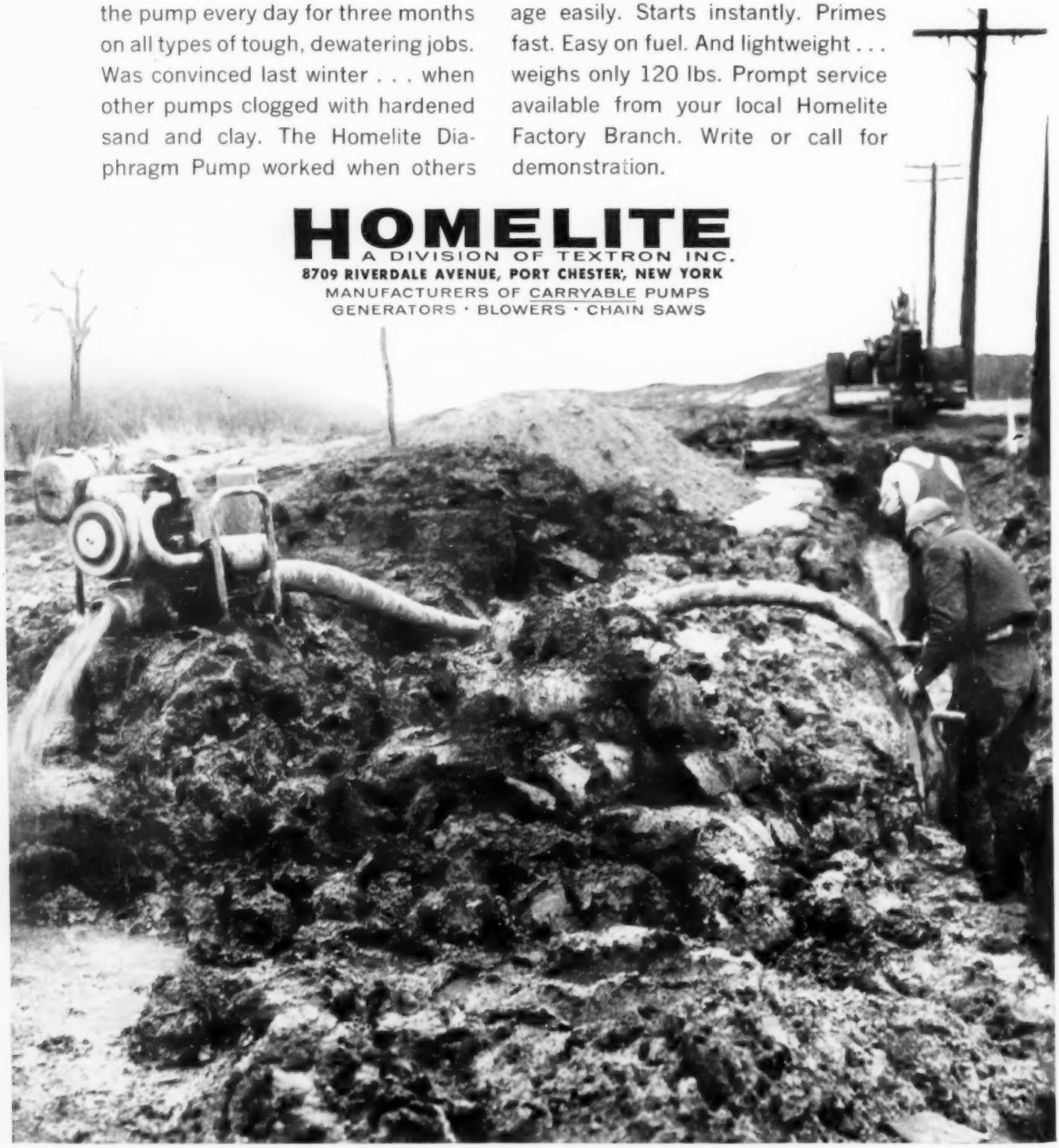

Complete Line of Homelite Carryable Construction Equipment Now Available

Self-Priming Centrifugal Pumps . . . Carry these lightweight, dependable pumps anywhere. Non-clogging design . . . 28 foot suction lift . . . capacities up to 15,000 g.p.h. . . . sizes from 1½" to 3". Diaphragm pump also available.

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PORT CHESTER, NEW YORK

Foamite Extinguishers Require Special Care

Here's a true story of how a two and one-half gallon foamite extinguisher killed a fire fighter. It happened in the drum reconditioning plant at Kaohsiung, Formosa.

Spillage from a used drum was ignited by a welders torch. He picked up the nearest extinguisher, turned it upside down but nothing came out. He shook it vigorously, cautiously eyeing the fire. Suddenly there was a violent explosion and the welder was killed as a result of the shrapnel-like bombardment.

Inspection of the extinguisher parts revealed an inch and a half of chalk-like matter clogging the hose near the nozzle. It was concluded that the clogged matter was formed after previous use and the hose was not flushed with water. Thus, the following rules were adopted:

- All classes of foamite extinguishers should be refilled with fresh solution at the interval of one year.
- Before refilling the outside and inside cylinder, nozzle and spray hose must be thoroughly cleaned. Also, the spray path should be checked for freedom of dirty substances.
- In accordance with the interval of refilling, the cylinder body of the extinguisher should be tested to a specified pressure.
- Powders should be completely dissolved in water. The procedure of preparation must carefully follow the directions.
- Date of refilling, expiration date, tested pressure and type of powder used are required to be punched on an aluminum plate. The plate (white arrow in picture) is hung on the handle or on the shoulder of the bottle after the extinguisher is refilled.
- Local supervisors are expected to make a monthly inspection of their own fire fighting equipment.

A unique method has been employed by the Chinese to prevent insects or dirt from clogging the extinguisher nozzles. They use a common narrow-mouth, rubber nipple from a baby bottle which is slipped over the nozzle (black arrow).

Tank Battery Entrance Is Made of Scrap Pipe

Here is an efficient and durable tank battery entrance that is a simple matter to construct. The 2-inch pipe frame is welded with the sides extending two feet beyond the sill. These extensions are set in concrete to make the unit stable, making side braces unnecessary.

A three-foot length of 1½-inch pipe is welded upright in the center of the sill to hold the turnstile made from a two-foot piece of pipe with a plate welded on one end. Four ½-inch rod arms are welded to the pipe. When this unit is complete it can be slipped over the 1½-inch post and rotates freely.

TESTED IN OPEN COMPETITION

. . . and ANOTHER Pipe Line Company CONVERTS TO

John Crane®

8-B SEALS

A COMPETITIVE FIELD TEST in which one half the pumps were equipped with JOHN CRANE 8-B Seals and the other half with various competitive seals was recently conducted by a leading pipe line company.

THE RESULT showed that in *every* case the JOHN CRANE 8-B Seals out-performed all other seals in the system both in positive sealing and length of service.

PROOF AGAIN that wherever service is tough and pressures are high, 8-B Seals successfully do the job.

JOHN CRANE 8-B Seals are easily installed and will handle all pressures encountered in modern pipe lines. They are available in a full range of shaft sizes for every main line or tank farm pump service.

Request Bulletin S-215-1. Give mechanical and service details for specific recommendations.

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Covered Half Drums Keep Stations Clean

At one South Texas compressor station, a number of old oil drums have been cut in half and plate stock welded across the bottom as shown. Two pieces of bent rod are welded to the sides for handles.

These drums are placed at locations around the station where waste materials are normally discarded. By using a tight cover heavy enough to prevent being blown about by the wind, the station grounds are kept clean and free from waste.

Jib Made of Casing Extends Gin Pole Truck

A gin pole truck's utility bay may be extended by using an easily made jib. This extension allows the unit to reach through doorways and into otherwise inaccessible places.

To make the jib, chain a length of casing to the truck bed. Place the chain near the front of the joint, leaving it loose enough to allow the casing to "hinge."

Greater flexibility is afforded by attaching the winch line to the jib directly under the gin-pole block and the load at the rear end of the joint.

Anaconda Type CP Cable being buried on cathodic protection job. Special covering resists almost every soil condition you're likely to meet.

Special cathodic protection cable gives you longer cable life even in "problem soils"

Soils vary. One may be acidic. The next alkaline. One dry. Another wet.

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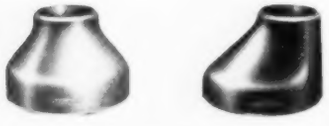

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Pipe Line Men

IN THE NEWS

F. K. Rader

H. L. Stowers

Texas Gas Transmission Corporation has elected **F. K. Rader** vice president and **H. L. Stowers** vice president and chief engineer. Rader previously was assistant to the executive vice president and Stowers has been chief engineer for Texas Gas and a predecessor company for the past 14 years.

Rader joined Texas Gas in 1952 and has been responsible for all applications and Federal Power Commission activities except rates. Prior to 1952 he was employed by Shell Oil Company. Stowers was appointed chief engineer for Memphis Natural Gas Company in 1943 and continued in that position with Texas Gas following its merger with Memphis Natural. Before this employment he was with the Southwestern Light and Power Company of Oklahoma.

•

Fulton W. Copp, now manager of rates and sales for **Pacific Northwest Pipeline Corporation,** has been elected vice president for sales. Copp has been associated with Pacific Northwest since 1954. Previously he was a vice president of Northwest Natural Gas Company. Other employment background includes a period as staff engineer for the Federal Power Commission.

•

Bruce Ramsey, operations consultant to the president of **Interstate Oil Pipe Line Company,** has retired. Ramsey was long associated with Oklahoma Pipe Line Company, Interstate's predecessor. His career includes 37 years in the pipe line industry in the Mid-Continent area.

•

Bechtel Corporation has announced the association of **Alfred T. Krook** and his election as a vice president. Krook also has been elected to vice presidencies in Bechtel International Corporation and Canadian Bechtel Limited.

He will concentrate principally in Western Canada and Northwestern U. S. areas. Krook has been president and a director of Stone & Webster Canada Limited and a vice president of Stone & Webster Engineering Corporation.

•

Cities Service Gas Company has announced the appointment of **Kenneth E. Manner** to the post of assistant secretary. Manner recently joined the company as assistant to the secretary. He served on the field staff of the Bureau of Rates and Gas Certificates of the Federal Power Commission from 1947 until he joined Cities Service.

•

J. C. Bauguss, Jr., has been appointed valuation engineer for **Southern Pacific Pipe Lines, Inc.** His headquarters are in Los Angeles.

•

R. E. Clarke has been appointed to the new position of manager, natural gas utilization for **Standard Oil Company of California. Clarke** formerly was manager of the gas organization in the Producing department.

•

Millard K. Neptune will head **Texas Eastern Transmission Corporation's** Products Pipe Line division. Neptune, formerly general manager of Sahara Petroleum Company, Alexandria, Egypt, will fill the newly created post of executive vice president, Products division, and will be in charge of all products pipe line operations. Neptune has been associated with the oil industry for the past 25 years in various positions.

Millard K. Neptune

•

H. F. Tomfohrde Jr. has been promoted to manager of the newly created Transportation and Supply department for the Eastern division of **Tidewater Oil Company.** Formerly manager of the Divisional Lubricants Supply department, Tomfohrde will be succeeded by **Leonard W. Doolan, Jr.,** who joined the company in 1935.

Tomfohrde will direct the operations of marine, traffic, bulk terminal planning, purchasing, inventory control, Tide Water Pipe Co., Ltd., engineering and building maintenance and the pipe lines section. He joined Tidewater in 1929 as a development engineer.

•

Trans-Canada Pipe Lines Limited has appointed **Edmund M. Foo** gas engineer in the Gas Supply department of the Calgary office. Foo was a former project engineer with Alberta Petroleum and Natural Gas Conservation Board. He worked with Chemical and Geological Laboratories Ltd. before joining the conservation board as assistant gas engineer.

•

Texas Gas Corporation has moved into its new building at 2472 Bolsover Road in Houston. The general offices occupy 5000 square feet on the third floor of the new

is your pipe line a hog for pigs?

read how one Eastern pipe line COMPLETELY ELIMINATED this problem with KONTOL 77

THIS CHART PROVES KONTOL 77 EFFECTIVENESS

	Date	"C" Factor	Use of Pigs
BEFORE KONTOL 77	May	125	4 knife scrapers, 1 brush scraper
	June	125	10 knife scrapers, 1 brush scraper
	July	127	6 knife scrapers
	August	130	20 knife scrapers
	September	132	26 knife scrapers
	October	138	18 knife scrapers
KONTOL 77 was used here!	December	141	14 knife scrapers
	February	141	6 knife scrapers
	February (following year)	141	**NO SCRAPERS FOR ENTIRE YEAR!**

Increased dependency on scrapers . . . dollar-robbing decrease in throughput . . . discolored hydrocarbons . . . plugged up scraper traps—are these a few of the pipeline problems plaguing your present pipeline operations?

They *were* also the daily headaches facing this eastern pipe line. But within a few short months they became past history when KONTOL 77 went on the job. *Not a single scraper was used for an entire year!* The "C" factor went up, throughput was permanently improved.

Another important fact: KONTOL 77 meets military specifications as an approved rust and corrosion inhibitor for use in jet fuels and automotive gasoline.

Why don't *you* let KONTOL 77 work for you and your pipe lines? You'll save dollars and hours for the pennies invested.

SEE YOUR KONTOL SERVICE ENGINEER SOON.

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FREE KONTOL 77 BOOK

Lists complete technical data. Yours on request.

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building and 20,000 square feet on the fourth floor, tripling the amount of space formerly occupied.

•

Tuloma Gas Products Company has named **Charles M. Cole Jr.** as chief engineer. The position of chief engineer is newly created to supervise the construction and operation of the company's product storage installations, truck terminals and other supply facilities.

•

Roy G. Wetzel, formerly superintendent of measurement for **Southern Gas Company**, has been appointed head of the Tulsa office of Vickery-Simms, Inc.

The Texas Pipe Line Company has approved several changes in corporate officers. **C. E. Landon** will assume the duties of assistant to management, **W. R. Griffin, Jr.**, will serve as treasurer and head financial officer and **L. J. Shelton** was elected comptroller.

W. R. Griffin, Jr.

Landon has served as treasurer since 1947 after joining the company in 1919 and holding various positions. Griffin was formerly comptroller and has been with Texas Pipe Line since 1937. Shelton, formerly secretary and treasurer of an affiliated company, began working for Texas Pipe Line Company of Oklahoma in 1926.

•

E. A. Fuller has been named manager of pipe lines for The British American Oil Company Limited, Production and Pipe Line department, Calgary. Fuller joined Canadian Gulf Pipe Line Company in 1955 as assistant manager and was appointed assistant pipe line manager when British American acquired Canadian Gulf in 1956.

•

Fred C. Koch has been elected a member of the board of directors of **Northern Natural Gas Company.**

Fred C. Koch

Koch has been active for 35 years in the petroleum industry. He is currently president and director of the following companies: Wood River Oil and Refining Company, Rock Island Oil and Refining Company and the Koch Oil Corporation, all of Wichita.

Other directorships held by Mr. Koch include the First National Bank of Wichita, the Koch Engineering Company, the Clover Oil Corporation and the Vance Oil Corporation, all of Wichita.

•

The Somerville Construction Company has named **Cliff Williams** to the newly created post of safety director and equipment superintendent. Williams has been with Somerville five years and has an eight-year pipe lining background. The job includes directing the safety of men on construction projects and public safety on gas distribution projects inside city limits.

•

George E. Ludwig, general manager of Michigan Consolidated Gas Company's Muskegon district, has been elected president of the **Michigan Gas Association. L. L. Perry**, vice president and general manager of Michigan Gas and Electric Company was named to the post of vice president and **Milton G. Kendrick**, sales manager of Michigan Consolidated's Ann Arbor district, was re-elected secretary-treasurer.

•

Bruce A. Eckerson has been named process engineer in the gas department of **Signal Oil and Gas Company.** Eckerson was formerly an engineer with California Research Corporation for 12 years.

•

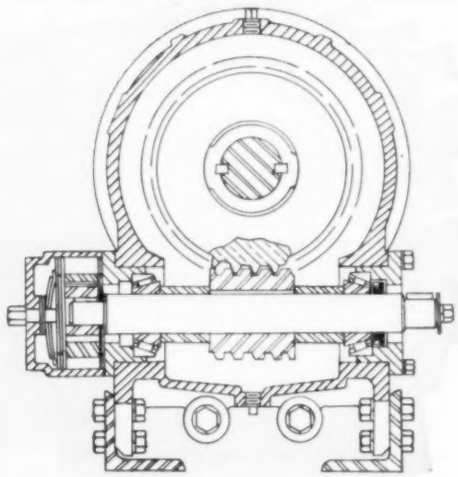
J. D. Behling has been promoted to division chief engineer in the West Texas division of **Service Pipe Line Company. M. C. McNichol**, oil traffic engineer, was promoted to assistant supervisor of oil movements in the Tulsa office. He replaces Behling.

•

Trans-Western Pipe Line Company, newly organized pipe lining firm, has elected **John R. McMilan** as president. McMilan is executive vice president of Monterey Oil Company. **R. C. Frederick**, gas coordinator with Gulf Oil Corporation, is vice president. Warren Petroleum Corporation, Monterey Oil Company and J. B. Butler, Houston consulting engineer, are the new company's organizers.

BRADEN TRUCK WINCHES

Here's Where QUALITY Tells . . .



The BRADEN worm gear is made of solid bronze alloy (on light and medium duty models), and solid bronze alloy cast around solid steel hub (on heavy-duty models). The shell type worm is made of hardened and ground, special treated alloy steel.

These two gears, the heart of the mechanism of the winch, are engineered to give an extra margin of safety should the operator load the winch beyond its rated capacity.

BRADEN Truck Winches are made in capacities from 6,000 to 100,000 pounds. Specify BRADEN Winches . . . and be sure!

WRITE FOR CATALOG

BRADEN WINCH COMPANY
P. O. Box 547, Broken Arrow, Oklahoma

BRADEN Winches

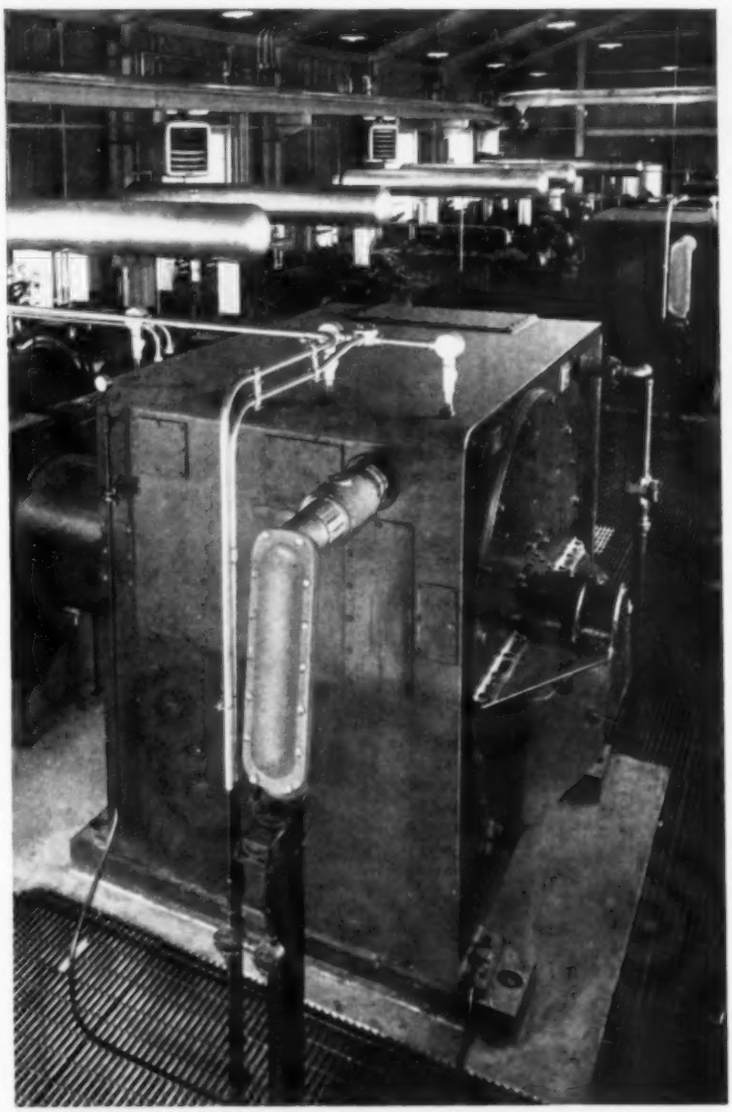
In service around the world

ELLIOTT inert-gas-cooled motors solve refinery safety problem

Shown here are three Elliott 1000-hp, inert-gas-cooled motors driving reciprocating compressors which serve a catalytic reforming unit having a rating of 10,000 barrels per stream day.

Normally, motors for use within battery limits of light hydrocarbon processing units are of explosion-proof type. Because of the large size required, these inert-gas-filled (water cooled) totally-enclosed motors were chosen as safest and most economical for the application. Their satisfactory operation is evidence of the correctness of this choice.

The broad experience of Elliott engineers is available to help you select electrical equipment for either new or modernized installations. Inquire of our nearest District Office, or write Elliott Company, Ridgway Division, Ridgway, Pa.



Compressor room, showing three 1000-hp, 394-rpm, 2300-volt Elliott motors. They are of the "totally-enclosed, water-cooled" type, with inert gas instead of ambient air circulating over a tubular heat exchanger. The inert gas is introduced at a slight pressure of 0.15 psig. to maintain a positive pressure on the motor at all times.

ELLIOTT Company

STEAM TURBINES • MOTORS • GENERATORS
DEAERATING HEATERS • EJECTORS • CONDENSERS
CENTRIFUGAL COMPRESSORS • TURBOCHARGERS
TUBE CLEANERS • STRAINERS

RS-23

For more data on advertised products, use Readers' Service Cards, last page.

WHO'S MEETING WHERE

September

Independent Natural Gas Association of America, Annual Meeting, Shamrock Hilton Hotel, Houston, Sept. 8-10.

AIEE, Petroleum Industry Conference, Penn-Sheraton Hotel, Philadelphia, Sept. 9-11.

12th Annual Instrument-Automation Conference and Exhibit, Auditorium, Cleveland, Ohio, Sept. 9-13.

National Petroleum Association, 55th Annual Meeting, Traymore Hotel, Atlantic City, N. J., Sept. 11-13.

Midwest Gas Association, Gas School and Conference, Iowa State College, Ames, Iowa, Sept. 11-13.

Southeastern Gas Association Convention, Robert E. Lee Hotel, Winston Salem, North Carolina, Sept. 18-20.

Oklahoma Utilities Association, Gas Division Conference, Skirvin Hotel, Oklahoma City, Sept. 20.

ASME, 12th Annual Petroleum Mechanical Engineering Conference, Mayo Hotel, Tulsa, Sept. 22-25.

Mid-Continent Oil and Gas Association Louisiana-Arkansas Division, Roosevelt Hotel, New Orleans, Sept. 26-27.

Natural Gasoline Association of America Oklahoma Regional, Skirvin Hotel Oklahoma City, Okla., Sept. 27.

October

Texas Mid-Continent Oil & Gas Association, 38th Annual Meeting, Texas Hotel, Fort Worth, Oct. 1-2.

NACE, North Central Region, Sherman Hotel, Chicago, Oct. 1-4.

NACE, South Central Region, City Auditorium, Oklahoma City, Oct. 1-4.

The Society of Petroleum Engineers, AIME, 32nd Annual Fall Meeting, Adolphus, Baker and Statler Hilton Hotels, Dallas, Oct. 6-9.

American Gas Association, Kiel Auditorium, St. Louis, Mo., Oct. 7-9.

National Electronics Conference, co-sponsored by Illinois Institute of Technology, two other universities and two technical societies, Hotel Sherman, Chicago, Oct. 7-9.

AIEE, Morrison Hotel, Chicago, Oct. 7-11.

Oil Progress Week, Oct. 13-19.

NACE, Western Regional Corrosion Control Short Course, U. S. Grant Hotel, San Diego, Oct. 22-23.

NACE, Western Regional Meeting, U. S. Grant Hotel, San Diego, Calif., Oct. 23-25.

Seventh Biennial Permian Basin Tour, Odessa-Midland area, Oct. 23-25.

Natural Gasoline Association of America, Southern Regional, Washington-Youree and Captain Shreve Hotels, Shreveport, La., Oct. 25.

Independent Petroleum Association of America, Annual Meeting, Statler-Hilton Hotel, Dallas, Oct. 27-29.

November

Louisiana Polytechnic Institute, Sixth Annual Instrumentation Conference, Louisiana Polytechnic Institute, Ruston, La., Nov. 7-8.

Instrumentation Conference and Exhibit, Institute of Radio Engineers, Biltmore Hotel, Atlanta, Ga., Nov. 11-13.

API, 37th Annual Meeting, Conrad Hilton Hotel and Palmer House, Chicago, Nov. 11-14, 1957.

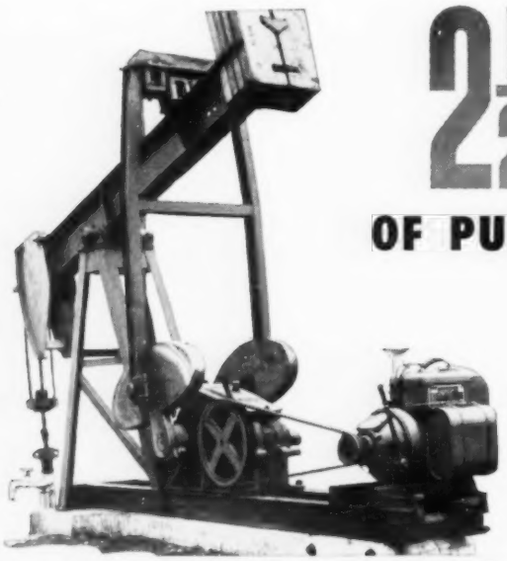
Natural Gasoline Association of America, Panhandle Plains Regional, Herring Hotel, Amarillo, Texas, Nov. 22.

National Association of Corrosion Engineers, Fall Meeting of Northeast Region, Penn-Sheraton Hotel, Pittsburgh, Nov. 12-14.

December

American Society of Mechanical Engineers, Annual Meeting, Statler Hotel, New York City, Dec. 1-6.

Third Biennial Short Course on Cathodic Protection, University of Illinois and NACE, Urbana, Ill., Dec. 9-13.



2½ YEARS
OF PUMPING SERVICE

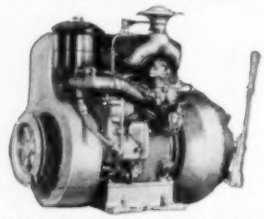
. . . no replacements other than spark plugs and magneto points on this **WISCONSIN Engine**

HERBERT FOWLER, pumper for the Ben Culver Oil Wells, operating in Osage County, Oklahoma, has been pumping Well No. 6 with a 2-cylinder Wisconsin Model TFPD Wisconsin Air-Cooled Oil Well Pumping Engine since its installation in Feb., 1954 . . . producing from the Mississippi Chat formation at about 2,000-ft. depth.

Fowler reports, in a sworn statement dated Sept. 4, 1956, that this engine was operated up to 10 hours per day, with an average of 6 hours per day pumping both oil and water. During the 2½-year period covered by this report, the engine had never been removed from its foundation. The cylinder heads had never been removed, valves had been adjusted only twice and the only service parts used were two sets of spark plugs and two sets of magneto points.

It is performance records such as this that offer convincing proof of Wisconsin Heavy-Duty Air-Cooled Engine stamina and low-cost maintenance. They're built to "take it" under *your* operating conditions . . . and there's an engine of the right size to fit your requirements . . . 4-cycle single cylinder, 2- and 4-cylinder models, from 3 to 56 hp., backed by a service organization second to none for swift attention to your needs.

Model TFPD Wisconsin Oil Well Pumping Engine



Get the details about this 2-cylinder Wisconsin Heavy-Duty Air-Cooled Oil Well Pumping Engine, with built-in HIGH MOMENTUM FACTOR.

WISCONSIN MOTOR Corporation
MILWAUKEE 46, WISCONSIN
World's Largest Builders of Heavy-Duty Air-Cooled Engines

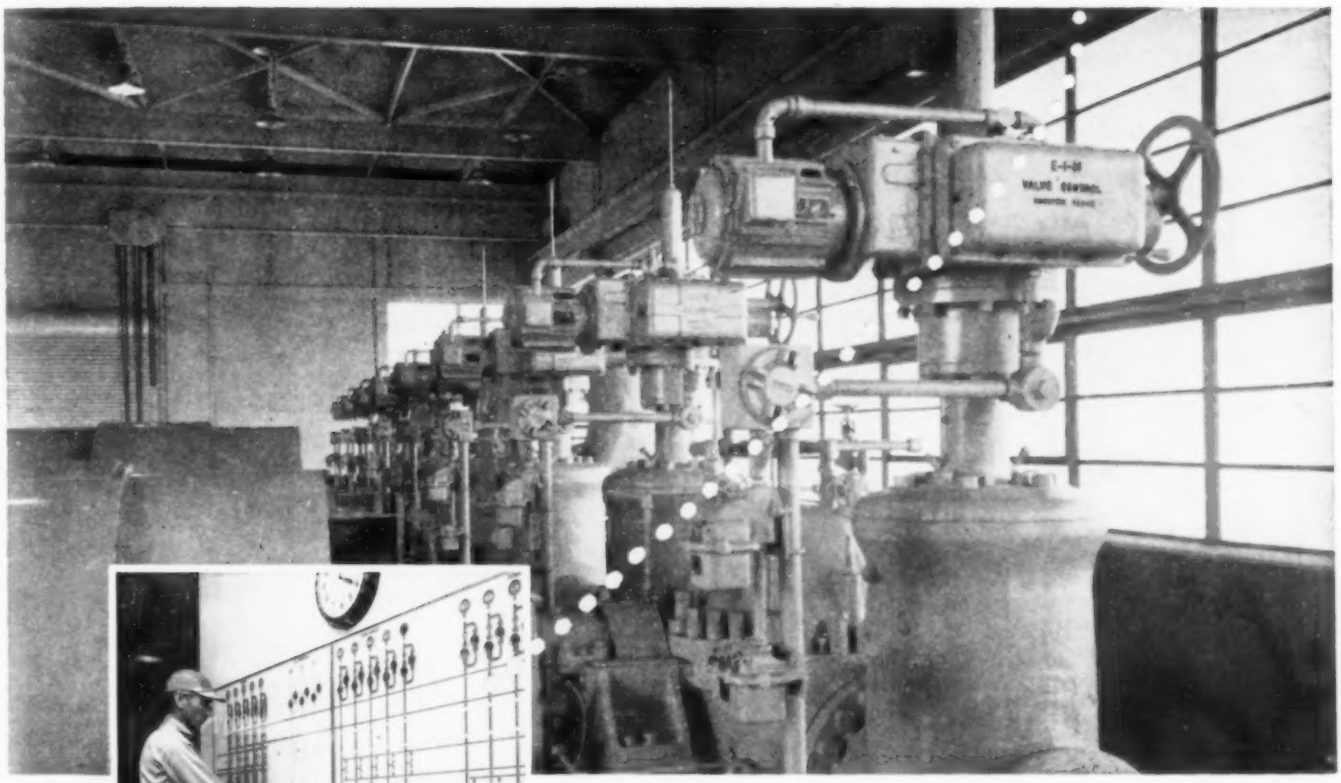
WRITE TO HARLEY SALES CO.
619 SOUTH MAIN STREET • TULSA, OKLAHOMA
3420 McKINNEY AVENUE • HOUSTON, TEXAS
505 SOUTH MAIN STREET • WICHITA, KANSAS

OIL FIELD DISTRIBUTORS FOR WISCONSIN ENGINES AND ALL TYPES OF UTILITY UNITS

A7-6106

EFFICIENT, INSTANTANEOUS MOVEMENT

West Texas Gulf Pipe Line Co., like many outstanding transmission lines, makes E-I-M Valve Controls the heart of the modern pumping station—striking a single push-button automatically opens the station block-valve and in sequence the pump suction-valve, pump motor, pump discharge-valve



E-I-M Company
INCORPORATED

1340 OLD SPANISH TRAIL • HOUSTON 25, TEXAS • MOhawk 4-4587

Valve Controls • Speed Reducers • Cooling Tower Drives • Control Valves

MERCOID®

EXPLOSION PROOF

SAFETY CONTROLS

For

PRESSURE
TEMPERATURE

Hermetically sealed mercury switch

Visible On-Off circuit

Visible calibrated dial

Visible operating point indicators

Outside adjustments

Explosion-proof housing (Rugged in construction)

SERIES DAE AND DSE

Mercoid Controls are available in steel cabinets made to your specifications.

Built to last the life of the equipment it serves

Our engineers are at your service —send in your control problem.

THE MERCOID CORPORATION
4201 Belmont Ave., Chicago 41, Ill.

What's Happening

AMONG SERVICE AND SUPPLY MEN

William McKee

Robert Williams

National Tube Division Elevates McKee and Williams

Two major appointments in U. S. Steel's National Tube Division Sales department were announced recently.

William J. McKee, now general manager of sales, will become assistant vice president of sales and Robert E. Williams, director, distribution and availability, is general manager of sales, succeeding McKee.

McKee began his business career with National Tube Company in 1912 in McKeesport. Williams started his steel career as a draftsman in the General Sales department of the former Columbia Steel Company in San Francisco in 1935.

Rockwell Manufacturing Company Promotes Sylvester and Perry

Russell L. Sylvester, chief engineer of Rockwell Manufacturing Company's Central Valve Research and Development department, has been promoted to engineering executive assistant of Republic Flow Meters Company of Chicago, newly acquired Rockwell subsidiary.

Russell Sylvester

A registered professional engineer, Sylvester spent a number of years as director of project engineering, Kinney Manufacturing Company (division of N. Y. Air Brake, manufacturers of pumps and valves).

Charles N. (Chuck) Perry, purchasing agent for Rockwell Manufacturing Company's Oakland, Calif., plant for the past five and a half years, has been named factory manager of the company's new Porterville, Calif., plant.

Garlock Packing Company Makes Sales Additions

The appointment of W. W. Loveland, Jr., to a new territory in the Syracuse, N. Y., area was recently announced by The Garlock Packing Company. Loveland was formerly a member of the Product Engineering department.

John R. Strobel has been named sales engineer at Garlock's Denver branch. Strobel will service a territory consisting mainly of Nebraska and Arizona.

Norman S. Knauss has joined Garlock's sales force and has been assigned to the company's Detroit branch.

Malick and Spargo Given New Posts at Houston

K. D. Malick and L. H. Spargo have been appointed manager of petroleum and chemical sales, and of general industrial sales, respectively, in the Houston district office of Allis-Chalmers Industries Group.

Malick has been associated with Allis-Chalmers since 1939 and has been a sales representative in the Houston district since 1947.

Spargo joined Allis-Chalmers in 1942 and has been a sales representative in the Houston district for about ten years.

McBrien Joins F. H. Maloney As General Sales Manager

J. H. McBrien

James H. McBrien has been named general sales manager for the F. H. Maloney Company. Headquarters are in Houston.

Most recently, McBrien has been the Houston branch manager for Midwestern Pipeline Products Company. Prior to that, McBrien was a corrosion engineer for the Great Lakes Pipeline Company and sales and service engineer for T. D. Williamson, Inc., and Tod Pazdral.

James Barrens Assigned Eastern Sales Territory

James M. Barrens has been appointed unions sales representative for Clayton Mark & Company in the eastern coastal states. For the past seven years he has been a buyer of pipe valves and fittings for the Lummus Company, design and construction engineers for the oil and chemical industries.

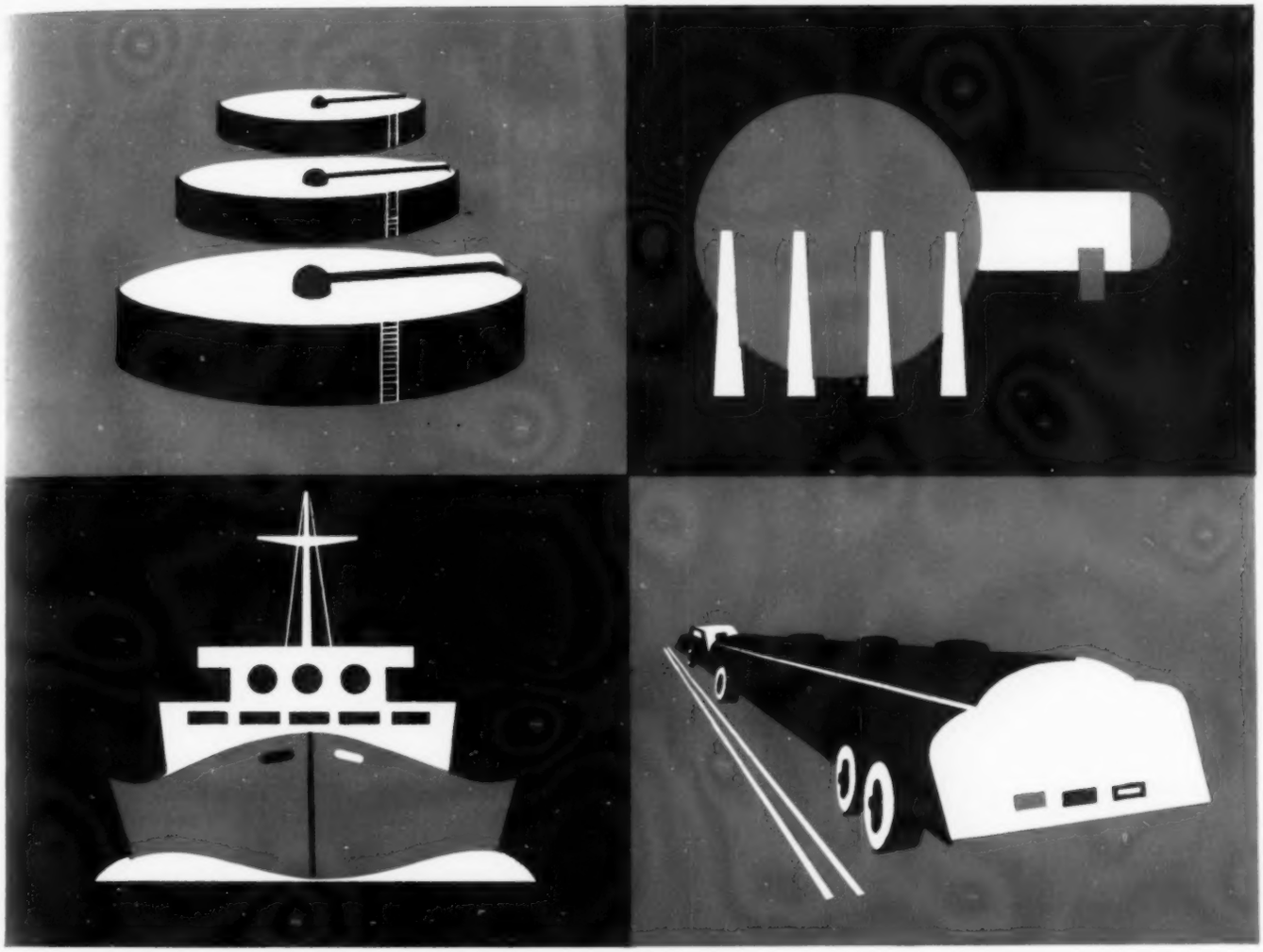
Lundy Made Sales Manager Of Peerless Pump Division

Announcement is made of the appointment of Everett W. Lundy to general sales manager of the Peerless Pump division, Food Machinery and Chemical Corporation. Lundy, previously assistant sales manager for the pump firm, succeeds B. A. Tucker, retired.

Lundy was first associated with the Sterling Pump Corporation, and joined the Peerless Pump organization in 1940.

Midwest Piping Company, Inc. Names Sales Co-Directors

Midwest Piping Company, Inc. recently named Phil R. Becker and Paul E. Kiebler as co-directors of sales. Kiebler, as director of engineering sales, will handle fabricated piping, piping erection and



World's most complete line of Storage Tank Fittings

Only Shand and Jurs offers world-wide availability and service on mechanical fittings — vents, gages and valves — for storage tanks. Stocks are maintained in key cities for prompt delivery to your tank farm, yard or depot.

Proved by over 36 years service, S&J tank fittings have set the industry standard for economy, safety, accuracy and dependability. Call or write your nearest S&J office for catalog and prices on the type of fittings you need.

S&J is also a world-leader in the manufacture of electrical remote supervisory control equipment.

SHAND AND JURS CO.
8th and Carleton Streets, Berkeley, California

a subsidiary of General Precision Equipment Corporation

NEW YORK	TULSA	LOS ANGELES	HOUSTON	CHICAGO
110 E. 42nd St.	Thompson Bldg.	6399 Wilshire Blvd.	M & M Bldg.	10409 S. Western Ave.

REPRESENTATIVES: **SEATTLE:** Nebar Supply Company, 3000 Western Ave. **MONTREAL:** Lytle Engineering Specialties, Ltd., 360 Notre Dame St., W. **TORONTO:** Lytle Engineering Specialties, Ltd., 69 Eglinton East. **VANCOUVER:** P. D. McLaren & Son, Ltd., 3277 Main St. **CALGARY:** P. D. McLaren & Son, Ltd., 510 - 9th Ave., W. **MEXICO, D. F.:** Dalma Commercial, S.A. **CARACAS:** Sinclair Spence, C. A. Edificio Galipan. **ENGLAND:** Whessoe, Ltd., Sales: 25 Victoria St., London S. W. 1 Whessoe, Ltd., Works: Darlington, County Durham.

4440

12,000 hp needs a lot of cooling!

One of six Young HC " 1415 units used to cool six 2,000 hp Ingersoll Rand Compressor engines at the new American Louisiana Pipeline Company's compressor station at Defiance, Ohio.

Young DOES THE JOB at this new compressor station

The entire cycle of cooling the engine jacket water and lube oil is automatic; each unit being complete with shutters automatically controlling the fan motors.

Wherever there are "big names" in industry you will find, with increasing frequency, Young heat transfer equipment in operation either as standard units or designed to meet specific requirements of an installation.

If you have a heat transfer problem contact your nearest Young Radiator Company representative — see yellow pages of your telephone book — or write to Young Radiator Company, Dept. 397-J, Racine, Wis. There is no obligation.

OIL FIELD and PIPELINE REPRESENTATIVES

1. Central Station Equipment Co. Tucson, Arizona
2. Flournoy & Everett, Inc. Downey, California
3. Jones and Laughlin Bradford, Pennsylvania
4. J. R. Meek Company Tulsa, Oklahoma • Houston, Texas
5. Frank Walz Denver, Colorado
6. Dutton-Williams Bros. Ltd. Calgary, Alberta, Canada
7. H. J. Young Muskegon, Mich.

"WHERE QUALITY COUNTS" Write for catalog 550 Dept. 397-J

Young RADIATOR COMPANY

RACINE, WISCONSIN

Creative HEAT TRANSFER ENGINEERS

Executive Office: Racine, Wisconsin, Plants at Racine, Wisconsin, Mattoon, Illinois

jobbed items. Becker, as director of manufacturing sales, will continue to supervise the sales of welding fittings and flanges and will act as manager of advertising and sales promotion.

Gilmore Hiett

K. H. Cadigan

Cadigan and Hiett Elected To Gorman-Rupp Board Posts

Kenneth H. Cadigan and Gilmore Hiett, sales and advertising executives, are newly-elected members of the board of directors of The Gorman-Rupp Company. Both officials joined the company in 1946. Cadigan is vice president in charge of sales and Hiett recently was promoted from manager of advertising and sales promotion to vice president.

The company also announces the promotion of Charles J. Taylor to the post of chief engineer. Formerly chief engineer for the Carver Pump Company, he joined Gorman-Rupp in 1953.

Le Roi Designates Plant And Engineering Manager

Donald M. McDowell has been named manager of engineering for the Le Roi Division, Westinghouse Air Brake Company. McDowell was promoted from the position of acting manager of engineering.

He joined Le Roi as chief development engineer in June of 1956.

Albert Feucht has been named manager of the Cleveland plant of the Le Roi Division, Westinghouse Air Brake Company. Feucht joined Le Roi in 1945 as chief engineer of the Cleveland plant, then a division of Le Roi.

Pacific Pumps Announces New Advertising Manager

William H. "Bill" Wagner has been appointed advertising and public relations manager for Pacific Pumps, Inc., a member of Dresser Industries.

Wagner had serviced the Pacific Pumps account during his entire 12 years as account executive and director of merchandising for The McCarty Company, Los Angeles, which will continue to represent Pacific Pumps.

Two Sales Representatives Named by Hamer Valves, Inc.

The appointment of two new sales representatives, the Henry Kalz Co., Portland, Oregon and Barber Machinery Limited, Calgary, Alberta, Canada, have been announced by Hamer Valves, Inc.

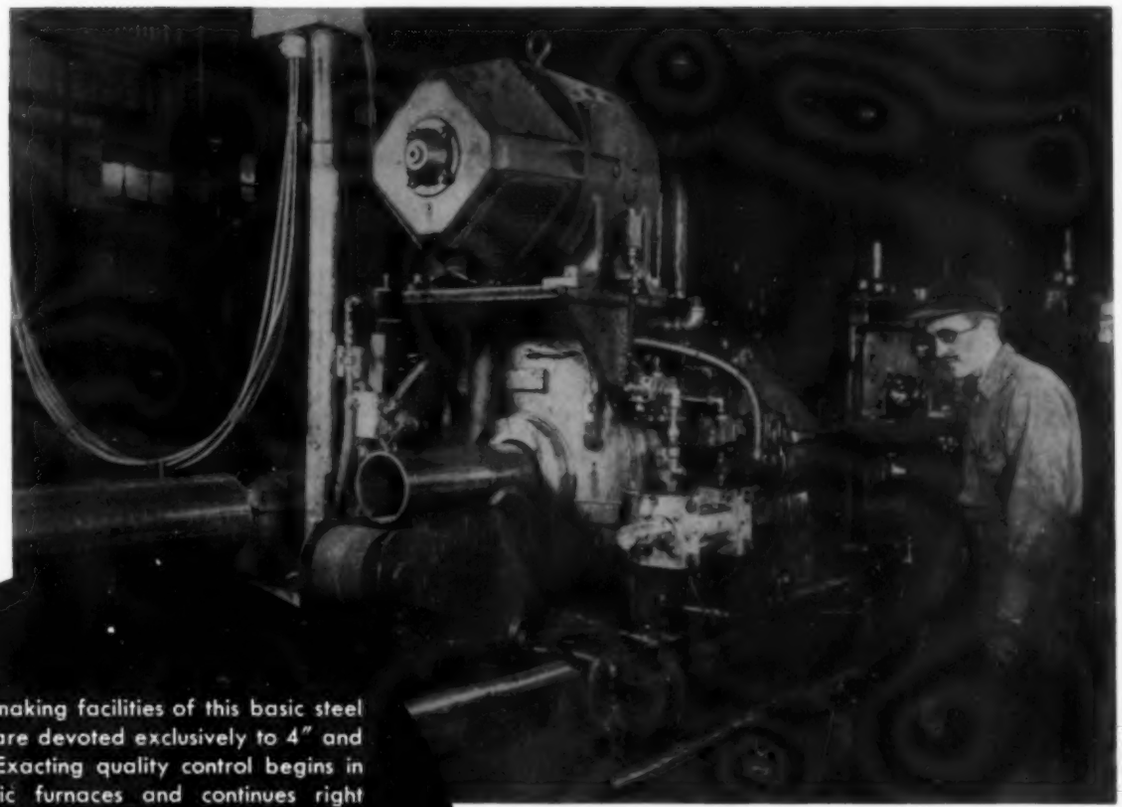
Both firms will provide sales engineering assistance on the complete line of Hamer products.

U. S. Steel Supply Division Makes Area, District Changes

Howard Rainbird has been appointed area manager of tubular sales at Edmonton, Alta. for U. S. Steel's Oil Well Supply Division. Other changes announced by U. S. Steel's Oil Well Supply Division include the appointment of Robert J.

Acme-Newport

SPECIALIZING IN 4" and 6" ELECTRIC WELD LINE PIPE*
UNIFORM IN QUALITY, ROUNDNESS, WALL THICKNESS



All pipe making facilities of this basic steel producer are devoted exclusively to 4" and 6" sizes. Exacting quality control begins in the electric furnaces and continues right through every steelmaking and pipe forming process. Each length is electric resistance welded, perfectly rounded, hydrostatically tested. Easy to bend, weld and install.

Available in both standard and thin wall. It meets every specification of API, ASTM and the user who wants uninterrupted service in the field. Before you buy again, let Acme-Newport tell you more about their quality and service.

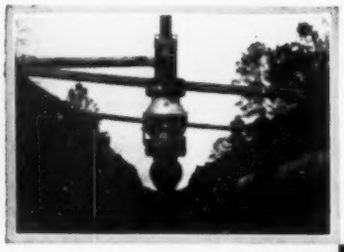
*SIZES AND WEIGHTS AVAILABLE

O.D.	Wall	Wt. Per Ft.
4½	.125"	5.84
	.142"	6.61
	.156"	7.25
	.188"	8.64
	.219"	10.00
	.237"	10.79
6⅝	.134"	9.29
	.156"	10.78
	.188"	12.89
	.219"	14.97
	.250"	17.02
	.280"	18.97

ECONOMICAL WATERAIL-TRUCK DELIVERY

This Company is ideally situated on the Mississippi-Ohio River system and the great Cincinnati rail-truck hub. New barge facilities, 7 major railroads and 143 motor carriers enable Acme-Newport to give economical, dependable delivery to the entire area of the Middle West and South.

Acme-Newport Steel COMPANY
NEWPORT, KENTUCKY
A SUBSIDIARY OF ACME STEEL COMPANY



STOPPLE APPLICATION
HOT TAPPING
PIGGING
BUSHINGS & INSULATORS

Agent for T. D. Williamson, Inc.

MARKER VENTS
AERIAL MARKERS
WELL MARKERS
SAFETY SIGNS

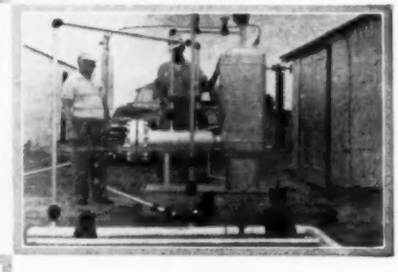
Sole Distributors for L & M Co.

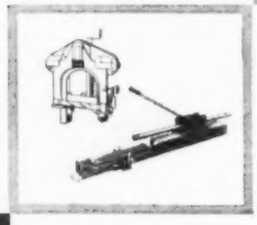
ASPHALT OUTERWRAP
ASPHALT COATING
ROCK SHIELD

Agent for Gulf States Asphalt Co.

H & H GAS ODORIZERS
Built to your specifications

Manufactured by Tod Pazdral





GUILLOTINE SAWS
NATIONAL SAWS

Agent for E. H. Wachs Co.

MERCURY HYDRAULIC
PIPE PUSHERS

Tell 'Em
We'll Be There!

You can depend on Topaz sales engineers to be on the job--on time--working in cooperation with your engineering department. Topaz service includes furnishing all equipment on a lease, contract or purchase basis. Call Topaz day or night . . . we'll be there!

TOD PAZDRAL — **ToPaz**

PIPELINE SPECIALTIES

2525 South Boulevard • Houston 6, Texas
Day Phone JA 2-1403 • Night Phone MA 3-5680

Mitchell as district representative at Edmonton, Alta., the transfer of Joseph L. Devlin, assistant district engineer at Red Deer, Alta., to Okotoks, Alta., and the appointment of Clarence H. Azbell as field representative, Newark, Ohio.

Robert G. Allen Chosen For Vice Presidency Post

Robert G. Allen has been elected to a new vice presidency created by Bucyrus-Erie Company. Previously Allen was president of the Pesco Products and Wooster divisions of the Borg-Warner Corporation, at Bedford and Wooster, Ohio.

R. G. Allen

Before joining Borg-Warner, he was vice president of the Great Lakes Carbon Corporation and general manager of its electrode division with plants. He formerly was president of the Duff-Norton Manufacturing Company. His business career began at the Walworth Company.

Canadian Fairbanks-Morse Company Appoints Canadian Distributor

The Canadian Fairbanks-Morse Company, Ltd. has recently been appointed Canadian distributor of Climax engines for Climax Engine Manufacturing Company, a division of Eversharp, Inc.

Headquarters of Canadian Fairbanks-Morse Company, Ltd. are located at Montreal, Quebec and main branches at Halifax, Nova Scotia; Toronto, Ontario; Winnipeg, Manitoba; Edmonton, Alberta; and Vancouver, British Columbia.

Tapecoat Company Establishes Separate Research Department

The establishment of a separate research and development department has just been announced by The Tapecoat Company, originators and manufacturers of coal-tar coating in tape form.

Heading the research staff will be Bernard Wolnak, president of Mid-West Laboratories. Development will be under the direction of John Branca, chief engineer in charge of this activity. Both programs are now under way.

Barrett Division Forms Tar Products Department

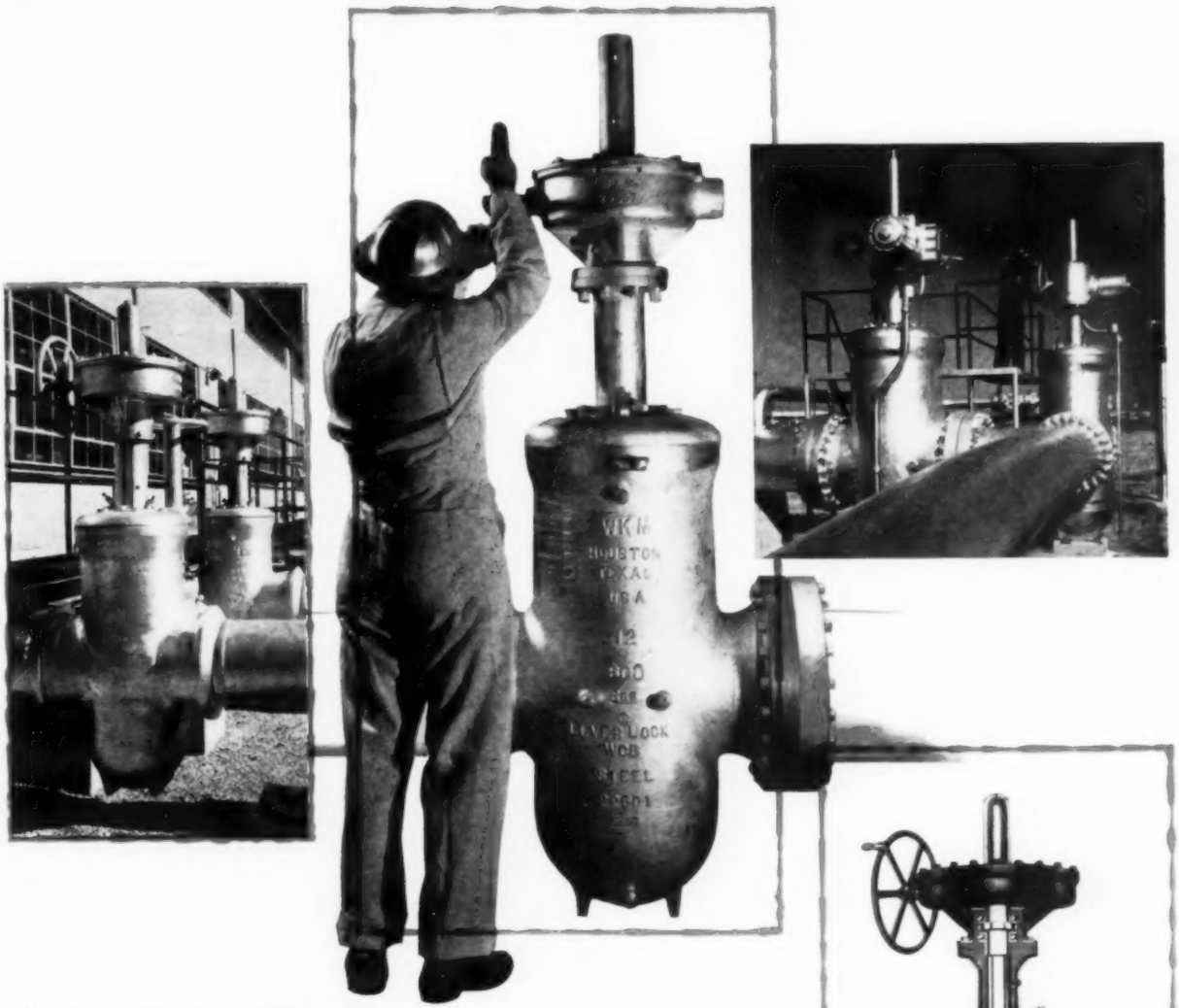
The formation of an Industrial Tar Products Sales department has been announced by the Barrett Division, Allied Chemical & Dye Corporation. This department is a consolidation of two separate sales organizations formerly designated as Creosote & Pitch Sales and Protective Coatings Sales, and is now under the direction of V. C. Otley, manager.

U. S. Rubber Gives Davis Branch Sales Position

Henry Davis, Jr., has been appointed assistant manager of branch sales for the mechanical goods division of United States Rubber Company. Davis joined the rubber company in 1945 as a technical trainee in mechanical goods.

In 1955 Davis became district sales manager for mechanical goods at the Baltimore Branch office, and later was named district sales manager of the Pittsburgh office.

For more data on advertised products, use Readers' Service Cards, last page.



W-K-M VALVES

STAY IN THE LINE FOR COMPLETE OVERHAUL

W-K-M® ASA Through-Conduit Gate Valves go in the line to stay —even if a complete overhaul or rebuilding job should become necessary.

All internal parts—gate and segment, seats, stem, bonnet, seal ring and clamp ring—can be replaced without removing the valve from the line, and certain other repairs can be made while the valve is *under pressure.*

Precise engineering and manufacture of **W-K-M** valves reduce maintenance to a minimum. But when repair needs do arise, costs stay low—because **W-K-M** valves stay "in the line."

***W-K-M** ASA Through-Conduit Valves are available in sizes 2" through 30"—ASA 300 lbs. to ASA 900 lbs. Valves up to 12" are available through supply stores.*

W-K-M is a registered trademark of ACF Industries, Incorporated.

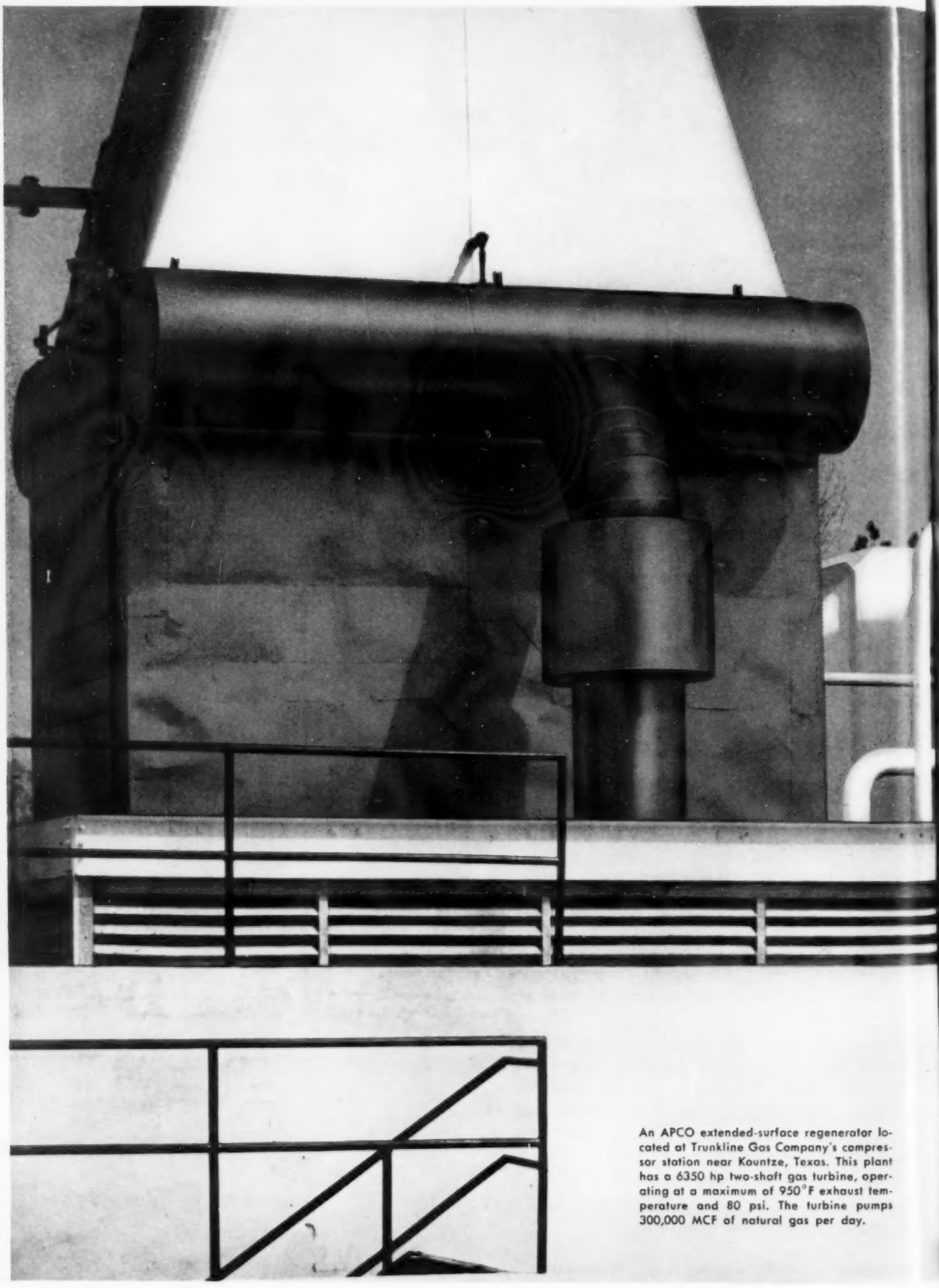
Bring your valve reference library up-to-date by writing Dept. J-9 for new W-K-M ASA Through-Conduit Gate Valve Catalog 300.

W-K-M
DIVISION OF ACF INDUSTRIES
INCORPORATED

PLANT: MISSOURI CITY, TEXAS
MAILING ADDRESS: P. O. BOX 2117, HOUSTON, TEXAS

5709

MANUFACTURERS OF W-K-M GATE VALVES · ACF LUBRICATED PLUG VALVES · KEY-KAST ALLOY STEEL PIPING FITTINGS · KEY RETURN BENDS AND FITTINGS



An APCO extended-surface regenerator located at Trunkline Gas Company's compressor station near Kountze, Texas. This plant has a 6350 hp two-shaft gas turbine, operating at a maximum of 950°F exhaust temperature and 80 psi. The turbine pumps 300,000 MCF of natural gas per day.

with pipeline costs soaring...

HOW MUCH CAN APCO REGENERATOR EQUIPPED GAS TURBINES CUT STATION MANPOWER?

A gas turbine equipped with a heat exchanger can cut man-power as much as 80% . . . compared to diesel, steam turbine, or gas-engine requirements. Only 7 to 9 men, on the average, are needed to maintain a gas turbine station.

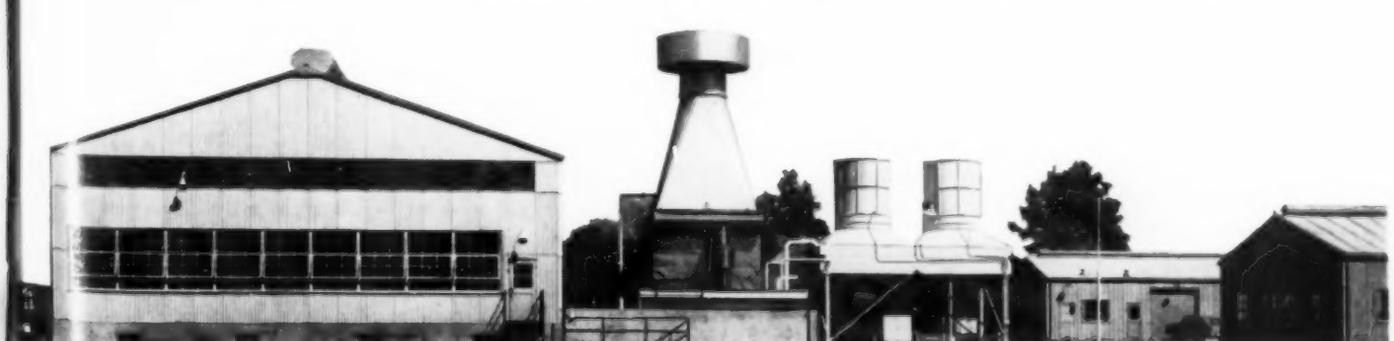
And when the heat exchanger is an APCO extended-surface regenerator, you get these extra advantages:

- The volume occupied is less than half of that required for other regenerators.
- The weight is half that of other regenerators.
- Less than 500 manhours are required for erection of a unit on a 5000 hp cycle.
- No maintenance is required.

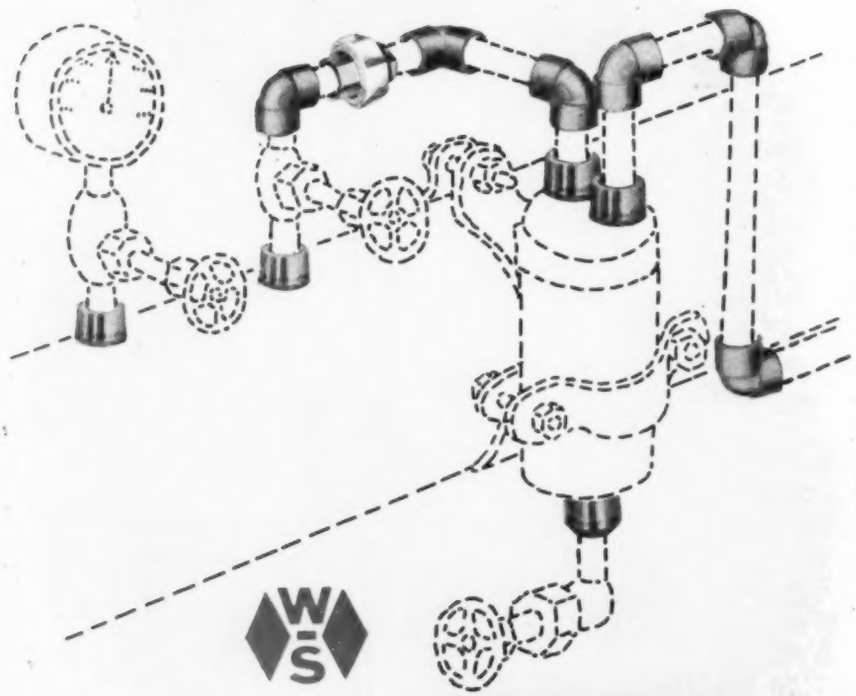
In terms of thermal efficiency, an APCO regenerator with 75% effectiveness can increase a gas turbine cycle operating at a 6-1 pressure ratio and 1500°F *as much as 7.5% absolute.* This is 32% over a cycle with no regeneration! And represents a fuel saving of about 30%. In other words, it saves 30% of the heat contained in the turbine exhaust heat, which would otherwise be expelled to the atmosphere.

Be sure to investigate the advantage of an APCO extended-surface regenerator, if you are considering gas turbines. For details of their labor saving efficiency, write Air Preheater Corporation . . . better yet, call and arrange for our engineers to sit down with yours.

The Air Preheater Corporation 60 East 42nd Street, New York 17, N. Y.



W-S Forged Steel Fittings...



Standouts in High Pressure Gas Lines

At the well . . . on gathering lines . . . on booster station piping . . . and in other high pressure gas lines, ⅛" to 4" in size, W-S Fittings protect piping systems against costly down time.

W-S Screw-end Fittings have smooth, precision machined threads, with extra long reinforcing bands extending well beyond the last thread. W-S Socket-Welding Fittings simplify installation of welding piping systems. Deep sockets help support and align the pipe for welding. Outside-the-pipe fillet weld means welding icicles can't form inside the pipe to obstruct flow.

For complete information on our complete line of forged steel fittings for high pressure service, send for Bulletin A-3. Write to W-S Fittings Division, H. K. Porter Company, Inc., P. O. Box 95, Roselle, N. J.

H. K. PORTER COMPANY, INC.
W-S FITTINGS DIVISION

NEW BOOKS

Flow of Natural Gas Through Experimental Pipe Lines and Transmission Lines, R. V. Smith, J. S. Miller and J. W. Ferguson, American Gas Association, 420 Lexington Avenue, New York 17, New York, $2.50.

This Bureau of Mines monograph presents the results of work done by the Division of Petroleum, Bureau of Mines, United States Department of the Interior, in cooperation with the Pipeline Research Committee of the American Gas Association. The monograph includes the work conducted under this cooperative study on the flow of natural gas in horizontal pipes. It includes the results of experimental flow tests conducted at Cliffside, Texas, and Goleta, Calif.

Monograph 9 will be of interest to engineers concerned with the design of gas pipe lines or with the determination of pipe line flow efficiency.

•

Pump Selection and Application, Tyler G. Hicks, McGraw-Hill Book Company, 330 West 42nd Street, New York 36, N. Y., $8.50.

This book is a guide to help engineers in all fields using pumps to get more economy and efficiency from their installations. Basic types of pumps and problems are discussed and one chapter is devoted to specific pumping problems of a number of industries, including power plant services, petroleum, chemicals, water supply, irrigation, flood control, construction and many others.

The author supplies step-by-step procedures for analyzing a pumping problem, finding the most suitable commercial pump for the job and applying this pump to the conditions encountered. More than 400 illustrations add to the description of a wide range of problems and pump types.

•

Unfired Pressure Vessels Code Simplified, Robert Chuse, P. O. Box 91, Leonia, N. J. $6.50 per copy.

This is a simplified analysis of the new 1956 ASME Unfired Pressure Vessel Code. The 1957 edition contains simplified charts for internal and external pressure, shell thickness, flanged and dished head thickness, flat head thickness, flat cover plate thickness, and openings and reinforcements. Lengthy problems can be solved quickly with the use of these charts. Also included in the book is a section on welding procedure. Single charts can be purchased for $1 each.

•

Hydrogen Absorption, Embrittlement and Fracture of Steel, Arnold E. Schuetz and W. D. Robertson, National Association of Corrosion Engineers, 1061 M&M Building, Houston 2, Texas, $2 in advance.

This 24-page illustrated report covers a four-year research project sponsored by the National Association of Corrosion Engineers' Technical Committee T-1G on Sulfide Stress Corrosion. The project was paid for by contributions of industries interested in so-called spontaneous fracture of steel. Authors Schuetz and Robertson are from the Research Department of the Bridgeport Brass Company and the Hammond Metallurgical Laboratory of Yale University respectively.

They Keep Oil on the Move

The Bethlehem pumps installed in this trunk pipe line were chosen for their ability to keep oil on the move—week after week, month after month. The neat, well-kept units shown above are powerful U-510's. Like all Bethlehem general-service pumps, they are backed by excellent field service and local supplies of parts—twin guarantees of first-class performance.

The U-510 is one of the five sizes of general-service pumps manufactured by Bethlehem. Three are the duplex type; the others are triplex. They're precision-engineered units that do a whale of a job in lease gathering and pipe-line work, refinery and gasoline service, etc. This line of pumps is also highly suitable for water-flooding, salt-water disposal, and service around the drilling rig. Pressure, capacity, and fluid handled are the factors that determine the actual choice of unit.

No matter which pump is selected, you are assured of advanced design and top-quality workmanship. Power ends are built for continuous full-load rating. Complete lubrication is furnished by a positive, gravity-flow system that functions perfectly at all operating speeds. Fluid ends (available in alloy-iron, steel, or aluminum-bronze) are engineered for the toughest service ever encountered.

The pumps are so versatile, so adaptable to conditions, that you can employ them on job after job. Call us for more details; we'll see that you get complete information.

Bethlehem General-Service Pumps

Model	Type	Plunger Load, Lb	Input Hp	Bore & Stroke, In.
U-33	Duplex	2400	13 @ 160 rpm	1¼ to 3 x 3
UA-46	Duplex	5000	40 @ 120 rpm	2½ to 4 x 6
U-510	Duplex	12000	100 @ 75 rpm	3 to 5½ x 10
TP-3	Triplex	3580	36 @ 400 rpm (max)	1¾ to 2¼ x 3
TP-4	Triplex	5000	67 @ 400 rpm (max)	2 to 4 x 4

BETHLEHEM STEEL

BETHLEHEM SUPPLY COMPANY

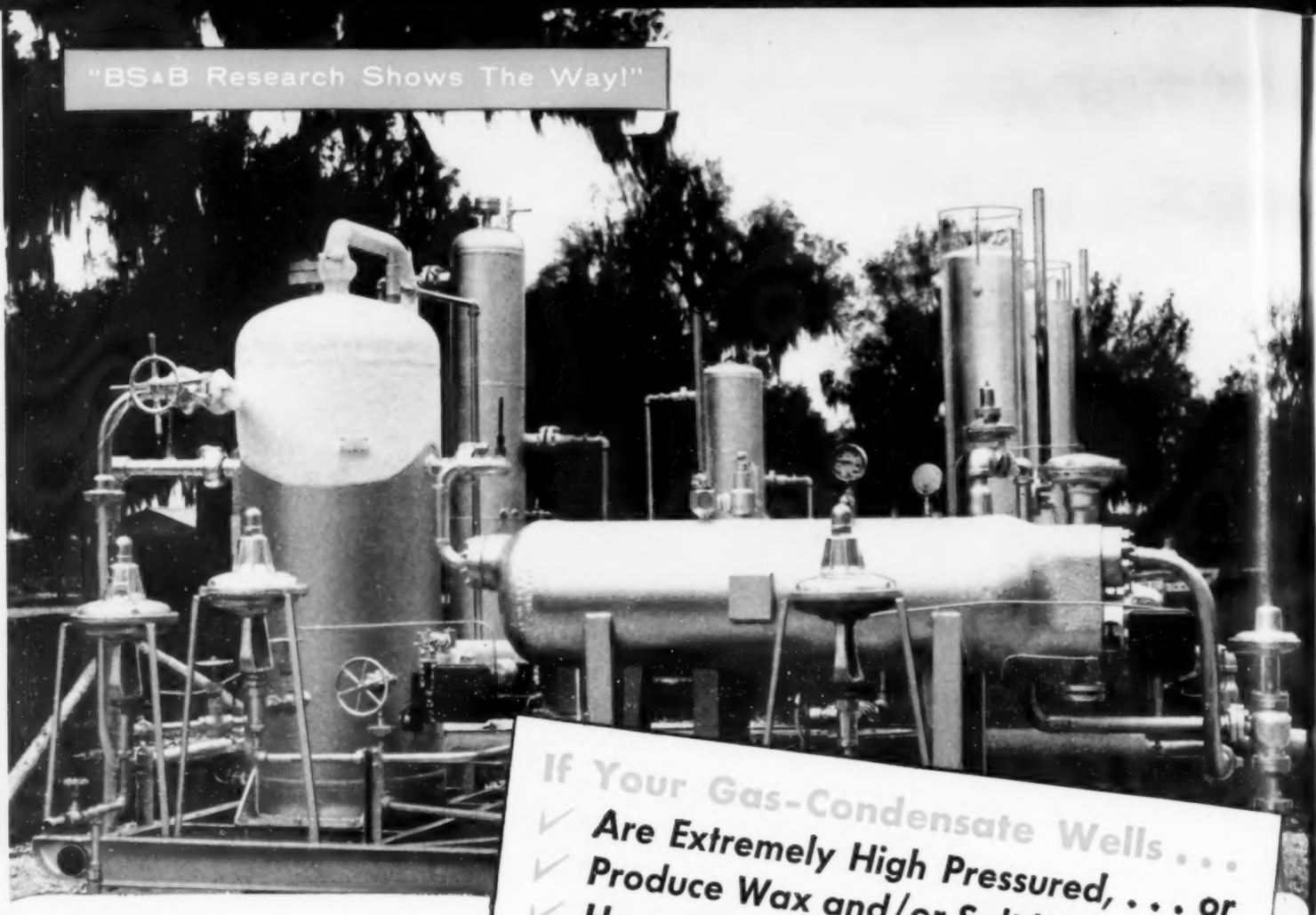
General Offices: 21 E. Second St., Tulsa, Okla.

West Coast Headquarters: Los Angeles, Calif.

Canadian Distributor: Bethlehem Supply Company of Canada, Ltd. Calgary, Alberta, Canada

Export Distributor: Bethlehem Steel Export Corporation 25 Broadway, New York, N. Y.

BETHLEHEM SUPPLY



If Your Gas-Condensate Wells . . .

- ✓ Are Extremely High Pressured, . . . or
- ✓ Produce Wax and/or Salt Water, . . . or
- ✓ Have A Pressure Life of 3 to 5 Years . . .

You Need The BS&B COLD-FRAC®...Model MDH For Most Efficient And Profitable Production!

IF the wellhead pressure of your gas-condensate wells is 3,000 psi or more, a BS&B Model MDH COLD-FRAC System will probably give condensate recoveries comparable with other much more elaborate low temperature separation systems. Specially designed heat exchanger achieves maximum cooling with minimum pressure drop through counterflow with cold sales gas.

IF your wells are producing wax and/or salt water, a BS&B Model MDH COLD-FRAC System, with its highly efficient Model DC Liquid Knockout, will effectively remove particles 10 microns in size or larger. This inlet knockout handles the maximum rated gas capacity without carryover while handling a normal volume of liquid. Waxy oils and salt water are efficiently removed and bypassed around the heat exchanger and choke.

IF your wells have a pressure life of 3 to 5 years, a BS&B Model MDH COLD-FRAC System will normally maintain the proper balance between initial cost and added recovery. More than 60 standard sizes are available from which to select the unit best suited to your requirements.

See Your BS&B Salesman For Detailed Information On BS&B COLD-FRAC Systems — Or Write To . . .

Other Types Of BS&B COLD-FRAC Systems...

ECON-O-MAX—for economical application of low temperature separation to small gas-condensate wells.

Model GDH—(with hydrate inhibitor) for maximum condensate recovery from wells having a pressure life of more than 5 years.

Gasoline Plants—for lease location or for central gathering stations.

Ammonia Absorption Refrigeration Units—for producing and maintaining temperatures below zero from energy supplied from natural gas fuel.

REFRIGERATION OVER 60 YEARS BS&B RELIABILITY
ANOTHER EXAMPLE OF PRODUCT LEADERSHIP

BLACK, SIVALLS & BRYSON, INC.

Oilfield Equipment Division, Dept. 1-EP9.

P. O. Box 1714 Oklahoma City, Oklahoma

What's New in Equipment

for the Pipe Line Industry

Strain Gage

The foil type SR-4 (bonded filament) strain gage is now available in two new types that provide fatigue life, sensitivity, and hysteresis characteristics superior to those of nearest equivalent bonded-wire SR-4 strain gages. Type FAP-2 and Type FAB-2 foil SR-4 strain gages have been developed by the Electronics and Instrumentation Division, Waltham, Mass., of Baldwin-Lima-Hamilton Corporation.

Prior to these new gages, the foil type SR-4 strain gage was used mainly to measure strains at high temperatures (up to 1000° F or higher.) In the "room temperature" range (up to 180° F) the earlier epoxy backed foil gages were inferior to bonded wire strain gages in performance. The new gages extend the useful "room temperature" range to 300° F for continuous duty, 400° F for short-time measurements.

The Type FAP-2 foil gage, a quick drying, paper-and-cement bonded gage, is directly comparable to the bonded-wire type gage A5-1. The Type FAB-2 foil gage, a Bakelite-bonded gage, combines the most desirable features of the AB-3 and AB-5 wire types.

For more data, circle **No. E1** on Readers' Service Card, last page this issue.

System Computer

Andrew Corporation has recently developed a system computer which will enable communication engineers to calculate rapidly and accurately parabolic antenna radiation characteristics, passive repeater performance, free space and "Scatter Propagation" attenuation and thermal and equivalent noise input of receiver.

On the reverse side of the computer is a transmission line and waveguide selector on which attenuation and power ratings as well as other electrical and mechanical characteristics are shown. The hand conversion rule facilitates computation of transmission line efficiency.

For more data, circle **No. E2** on Readers' Service Card, last page this issue.

Motors

Allis-Chalmers has recently made available vertical hollow-shaft motors in frame sizes 180 through 30 (Type HSZZ) in totally-enclosed and explosion-proof designs for hazardous locations or installations where excessive heat and dust require added protection. They are available in ratings to 700 hp in all types of enclosures including open, totally-enclosed, fan-cooled, and explosion-proof with either rigid or self-released couplings. Non-reverse protection is also available.

(This item supplements Allis-Chalmers data on Pages 41-44 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E3** on Readers' Service Card, last page this issue.

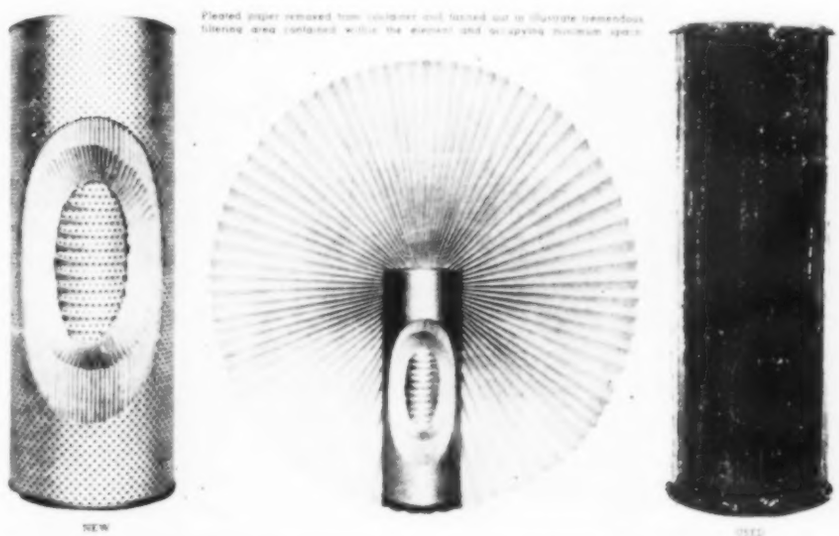
Indicator

A new digital flow indicator and totalizer, which gives a direct reading in gallons per minute or hour, can be adjusted to specific gravity changes to give readings in pounds per minute or per hour and will give direct readings of speed in revolutions per unit time, has been announced by the Potter Aeronautical Corporation.

When used with two Pottermeters, the new instrument, designated Model 43, will indicate the ratio between two flows. It samples the desired information for a controlled sample period, and is adjustable from 1/10 millisecond to 10 seconds in increments of 1/10 millisecond. This is equivalent to 100,000 time bases.

(This item supplements Potter Aeronautical Cororation data on Page 333 of the Pipe Line Composite Catalog, 1st Edition.)

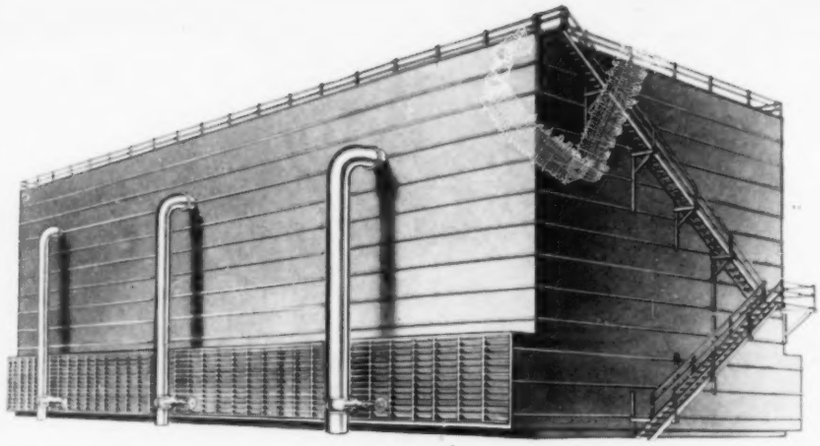
For more data, circle **No. E4** on Readers' Service Card, last page this issue.



Filter Cartridge

The Hilco laboratories of the Hilliard Corporation has patterned a high flow rate-low pressure drop filter cartridge, type PL, for the filtration of oil, water and many other liquids. The PL filter cartridge consists of a fine quality filter paper, impregnated with a heat stabilizing resin which is pleated and cured at the stabilizing temperature. This extended surface-type filter is then formed around a metal center tube and the end plates and a protective shield are attached.

Ideal for full flow filter applications, the cartridge will filter out particle sizes down to five microns with continuous recirculation resulting in even finer filteration. The added advantage of higher flow rate with lower pressure drop results in obtaining smaller cartridge casings than those offered for lower flow rated filter cartridges. For more data, circle **No. E5** on Readers' Service Card, last page this issue.



Cooling Tower

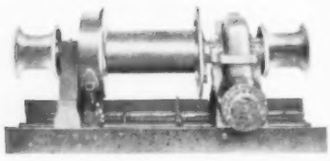
Innovations in both design and use of new materials are incorporated in the new Galloway Counter-Flow Cooling Towers. The entire tower is built of non-leaching "Chemonited" Douglas Fir which gives longer life and resists the attack of fungus. A "straddle bracing" system of construction utilizes the 33 percent advantage in modulus of elasticity which Douglas Fir maintains over conventional redwood structures.

This cooling tower uses stainless steel hardware for greater corrosion resistance, and features a vertical gear motor especially developed by Galloway-Westinghouse for cooling tower service. The manufacturer also offers a complete turnkey cooling tower installation including concrete basin, pumps, piping and electrical wiring.

For more data, circle **No. E6** on Readers Service Card, last page this issue.

PLENTY OF
PULL
POWER
PLUS PERFORMANCE

That's the guarantee you get when you put a Tulsa Winch to work . . . because Tulsa Winches are precision-made from highest quality materials, then tested to withstand pulls TWICE their rated capacities. They are designed for smoothest operation under the most rugged conditions . . . in a wide range of models and sizes. Also a complete line of power take-offs.



TULSA WINCHES

Tulsa Winch
TULSA OKLAHOMA DIVISION OF VICKERS Inc.

Autocar Kit

An Autocar rebuild kit—consisting of current-model production parts—can be used to rehabilitate any make of truck comparable to Autocar six-wheel diesel models DC 10264 and DC 10264 L (light weight). Providing all parts for a completely new Autocar chassis without power train (engine, clutch, transmission, drive line and front and rear axle assemblies), the kit is produced by Autocar Division of The White Motor Company, Exton, Pa.

The kit is expected to be used extensively for trucks in rugged, off-highway operations where the chassis frequently wear out before the power train. It will overcome chassis obsolescence in such low-mileage operations as logging, mining, quarrying and heavy construction.

Designated No. 216483, the basic kit consists of the following parts:

- Frame cross members and brackets
- Front springs and mounting parts
- Engine mounting parts
- Clutch control parts
- Steering gear and transfer lever assembly
- Complete radiator assembly
- Head lamps and mounting assembly
- Fender assemblies and mounting parts
- Running board and splash apron assembly
- Hood panel assembly
- Cab mounting parts

(This item supplements White Motor Company data on Pages 479-482 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E7** on Readers' Service Card, last page this issue.

COMPRESSION RING . . . 1-piece, quick-seating. Maximum strength. Turned finish on outside diameter lets ring conform readily to the cylinder bore. The chemically treated surfaces aid rapid seating, no scuffing or scoring during run-in. ½" to 120" diameters.

POROUS CHROME PLATED RING . . . exclusive Van der Horst process. Shallow porosity on cylinder contacting surface facilitates break-in, holds and distributes oil during this critical period. Lasts four times longer, cuts cylinder wear up to 75%. ½" to 42" diameters.

CONFORMABLE OIL RING . . . maintains constant pressure for positive oil control. Conforms to meet cylinder distortion; flexible cast iron member, pressed outward by abutment type spring exerts uniform radial pressure around entire circumference. 4" to 25" diameters, ¼" min. width.

KOPPERS SEAL RING . . . has one or two projecting bands of bearing bronze inserted in contacting face. Very quick-seating. Tends to prevent blow-by in new or worn cylinders. The burnishing action of bronze on cylinder walls decreases scuffing and wear. 2" to 30" diameters.

GROOVED OIL CUTTER RING...valuable where oil control is a major problem. Two bevels for riding over oil on up-stroke, two scraping edges for removing excess oil from walls on downstroke, plus a series of wide drainage slots. 1½" to 25" diameters.

Five Koppers Rings . . . worth their weight in gold!

What will American Hammered Industrial Piston Rings *do for you?* They'll save you money on fuel, on lubricating oil, on labor costs—by reducing down-time.

They'll maintain high compression, improve your operation, give you *much* longer service. They don't cost much . . . but they have over 35 years of manufacturing skill and accumulated experience behind them. They never let you down, they never fail in the jobs they're designed to do—and hundreds of satisfied users will tell you that, despite their low cost, Koppers rings *are* worth their weight in gold.

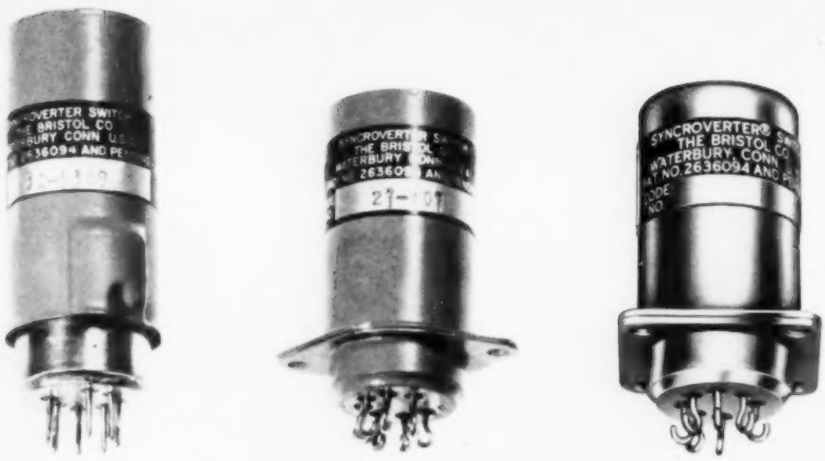
American Hammered Piston Rings are available in all types, all sizes—from ½" to 10' diameter—for every purpose. Koppers makes American Hammered Rings for all kinds of industrial equipment, can recommend without bias as to types. It costs nothing to consult Koppers—for illustrated Piston Ring booklet write to KOPPERS COMPANY, INC., *Piston Ring & Seal Dept.,* 7209 Hamburg Street, Baltimore 3, Md.

METAL PRODUCTS DIVISION • KOPPERS COMPANY, INC. • Baltimore 3, Maryland
This Koppers Division also supplies industry with Fast's Couplings, Industrial Gas Cleaning Apparatus, Aeromaster Fans, Gas Apparatus.
Engineered Products Sold with *Service*

KOPPERS ®

AMERICAN HAMMERED
Industrial Piston Rings

For more data on advertised products, use Readers' Service Cards, last page.



Choppers

Bristol's Syncroverter Switch, a precision, non-resonant inverter, is now being offered in over 75 optimized variations for low power and dry circuit applications. Wide variations in contact ratings, vibration and shock resistance, and frequency ranges are available to fit specific circuit requirements. Special low-noise and high temperature units are available where needed. Mounting arrangements to meet particular conditions are offered, including standard 7-pin plug-in bases or solder lug connectors with mounting flanges.

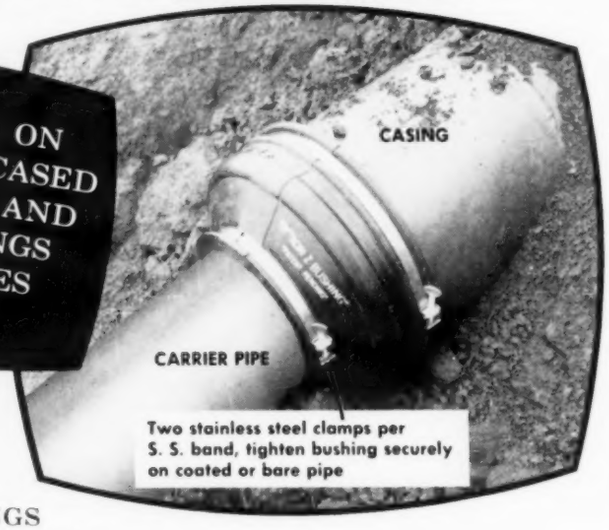
The chopper can be furnished in either SPDT or DPDT switching action. Miniature and larger sized units are available.

For more data, circle **No. E8** on Readers' Service Card, last page this issue.

They Go Together...

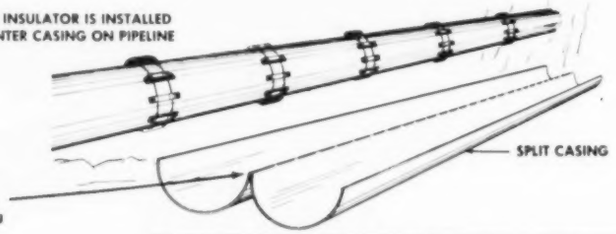
WmSEAL SPLICED "Z" BUSHINGS* for PIPELINES IN OPERATION

*INSTALLED ON EXISTING CASED CROSSINGS AND SPLIT CASINGS ON PIPELINES IN SERVICE



HERE'S AN EASY WAY TO INSTALL CASINGS ON LINES IN SERVICE

EVERY OTHER WmSON INSULATOR IS INSTALLED UP-SIDE-DOWN TO CENTER CASING ON PIPELINE



Interrupted torch-cut forms "hinge"—makes lineup easy for welding around pipe

Write for bulletin

Improved spliced "Z" Bushings are complete with easy to apply cold patch kit.

T.D.Williamson, Inc.

P. O. BOX 4038 TULSA 9, OKLAHOMA

REPRESENTATIVES: HOUSTON · AMARILLO · PITTSBURGH · PLAINFIELD, N. J. · JOLIET, ILL. · JACKSON, MICH. · LOS ANGELES · SAN FRANCISCO BARTLESVILLE, OKLA. · SEATTLE · EDMONTON · TORONTO · CALGARY VANCOUVER · BUENOS AIRES · CABIMAS, ZULIA, VENEZUELA · DURBAN, NATAL, SOUTH AFRICA · PARIS, FRANCE · SIDNEY, AUSTRALIA

Rotary Air Drill

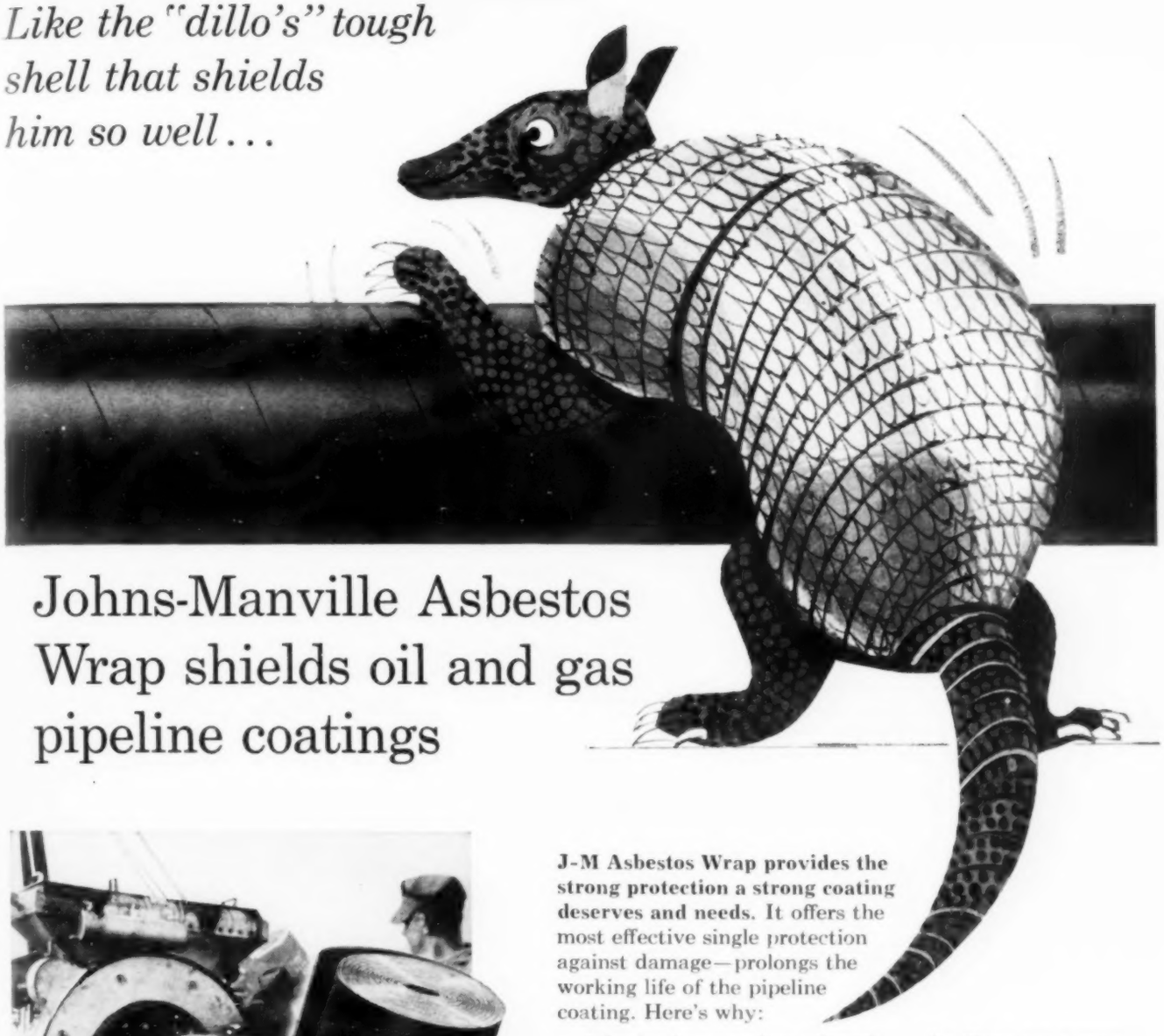
A rotary air drill mounted on a self-propelled air compressor has been developed by Schramm, Inc. Known as the Pneumatractor Rotadrill, this compact unit features convenient hole-to-hole maneuverability and economical operation. The Pneumatractor on which the Rotadrill is mounted is both a 125 cfm compressor and a wheel tractor so that the cost of a separate tractor is eliminated entirely.

The compact Rotadrill can be rapidly moved from hole to hole and can work in tight places where truck-mounted drills might encounter maneuverability problems. A low center of gravity combined with wheel-tractor drive allows this unit to negotiate rough terrain easily. Rotary air drilling is accomplished through a reversible hydraulic motor-driven head mounted on a carriage that rides tracks on the mast. This hydraulic drive eliminates the rotary table and Kelly bar. Holes can be drilled to 500 feet with 2⅞-inch OD flush drill pipe.

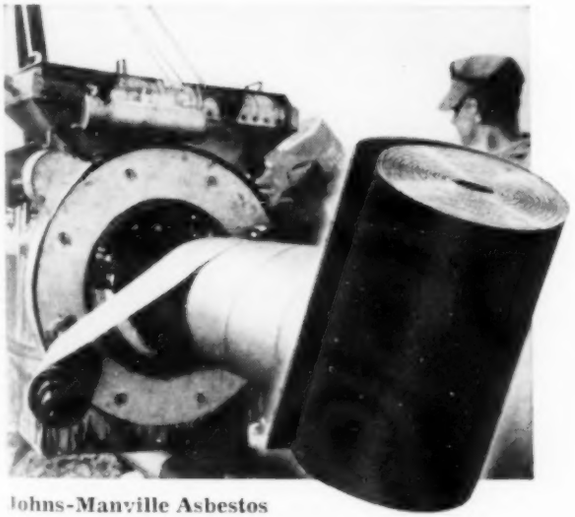
(This item supplements Schramm, Inc. data on Pages 346-347 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E9** on Readers' Service Card, last page this issue.

Like the "dillo's" tough shell that shields him so well...



Johns-Manville Asbestos Wrap shields oil and gas pipeline coatings



Johns-Manville Asbestos Felt is available in 3 types for field application or mill wrapping:

#15 Asbestos Felt—the high-strength, uniform asbestos wrap that has given superior protection to pipe coatings for more than 30 years—under the most severe soil conditions.

#15 Transhield®—heavyweight asbestos felt with parallel glass reinforcement for high tear strength.

#8 Transhield—standard-weight asbestos felt with parallel glass reinforcement—for low-cost protection against average soil conditions.

J-M Asbestos Wrap provides the strong protection a strong coating deserves and needs. It offers the most effective single protection against damage—prolongs the working life of the pipeline coating. Here's why:

Asbestos is an ageless mineral . . . the fibres are strong and tough—cannot rot or decay. As used in J-M Wraps, the asbestos fibres are felted, then impregnated with a cold tar or asphalt saturant to form literally a flexible covering of stone. Like the "dillo's" tough shell that shields him so well—the enduring, "stonelike" J-M Asbestos Wrap shields pipeline enamels from earth loads, soil stress, and other forces that weaken coatings and permit corrosion of the pipeline.

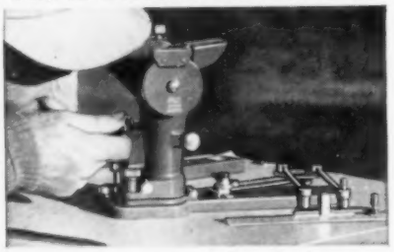
Invite one of our engineers to show you the results of the three-year, extensive test program on "Pipe Line Coatings and Wrappers." Write to Johns-Manville, Pipe Division, 22 East 40th Street, New York 16, N. Y.

✓ STRONG PROTECTION • PROVEN PERFORMANCE
RESISTANCE TO SOIL STRESS AND DEFORMATION
HIGH-SPEED APPLICATION • LONG-TERM INVESTMENT
SIMPLIFIES CATHODIC PROTECTION SYSTEMS
REDUCES HAZARD • INCREASES SAFETY

Johns-Manville PRODUCTS FOR PIPELINE PROTECTION

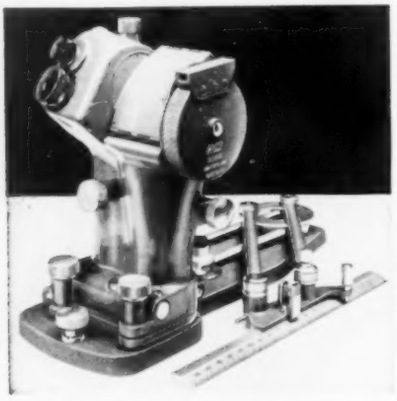
For today's competition . . .

TURN TO KERN INSTRUMENTS



For great savings of man-hours in the field. Highest precision results in shortest possible time.

DOUBLE YOUR PLOTTING SPEED



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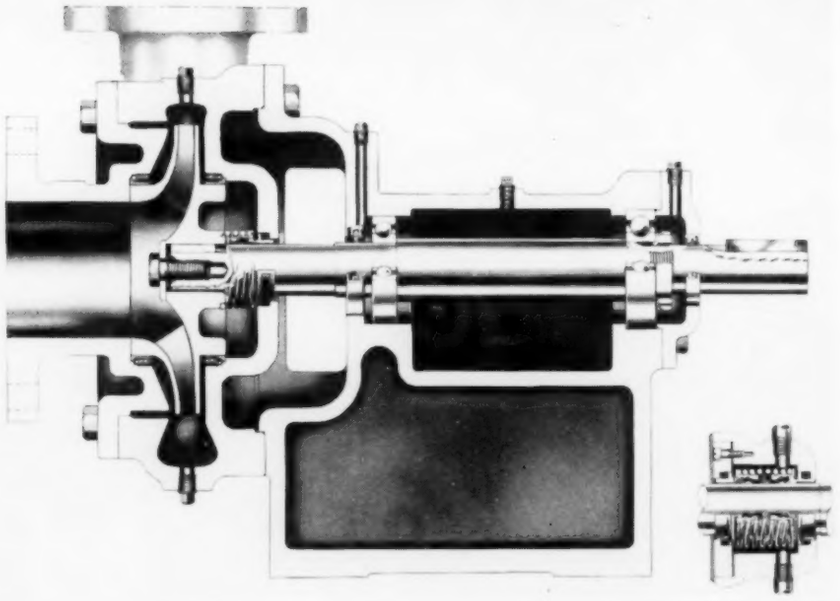


Centrifugal Pumps

A new line of high-speed, high-head centrifugal pumps for general water service has just been announced by Gardner-Denver Company. The new Model BH pumps are available in four sizes—a 1-inch model with capacities to 150 gpm, and 1½-inch model with capacities to 220 gpm, a 2-inch model with capacities to 440 gpm and a 3-inch model with capacities to 520 gpm.

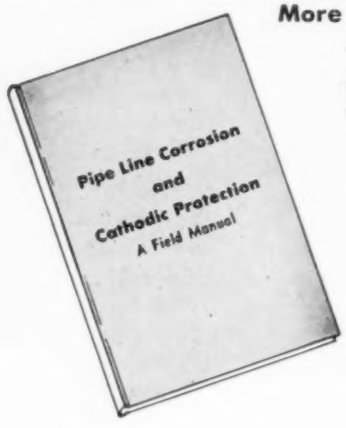
All perform at high efficiency over a wider-than-usual range of service conditions, and offer features of design and material that include stainless steel shafts, oil-lubricated heavy-duty ball bearings, mechanical seals, accurately contoured casings, and hydraulically balanced bronze impellers.

(This item supplements Gardner-Denver Company data on Pages 145-152 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E10** on Readers' Service Card, last page this issue.

More comments on this new Handbook:

". . . a most practical on-the-job manual for men concerned with pipe line corrosion. We are ordering copies for each of our district engineers."



Pipe Line Corrosion and Cathodic Protection

By MARSHALL E. PARKER

This Handbook, written by Marshall E. Parker, consultant, is designed as a practical field manual. It is a 108-page pocket-size volume printed first as a popular series in WORLD OIL. The Handbook is illustrated with many charts and drawings and is completely indexed by subjects.

It presents comprehensive data on Soil Resistivity Surveys, Potential Surveys, Line Currents, Current Requirements, Rectifier Systems, Ground Bed Design, Magnesium Anodes, Stray Current Electrolysis, Interference in Protective Systems, Operations and Maintenance, and Coating Protection and Testing.

An appendix has been added of technical data on Underground Corrosion, Basic Principles of Cathodic Protection, Properties of Metals and Attenuation Equations. Order copies of this practical Field Manual now for each of your field men. Price $3.

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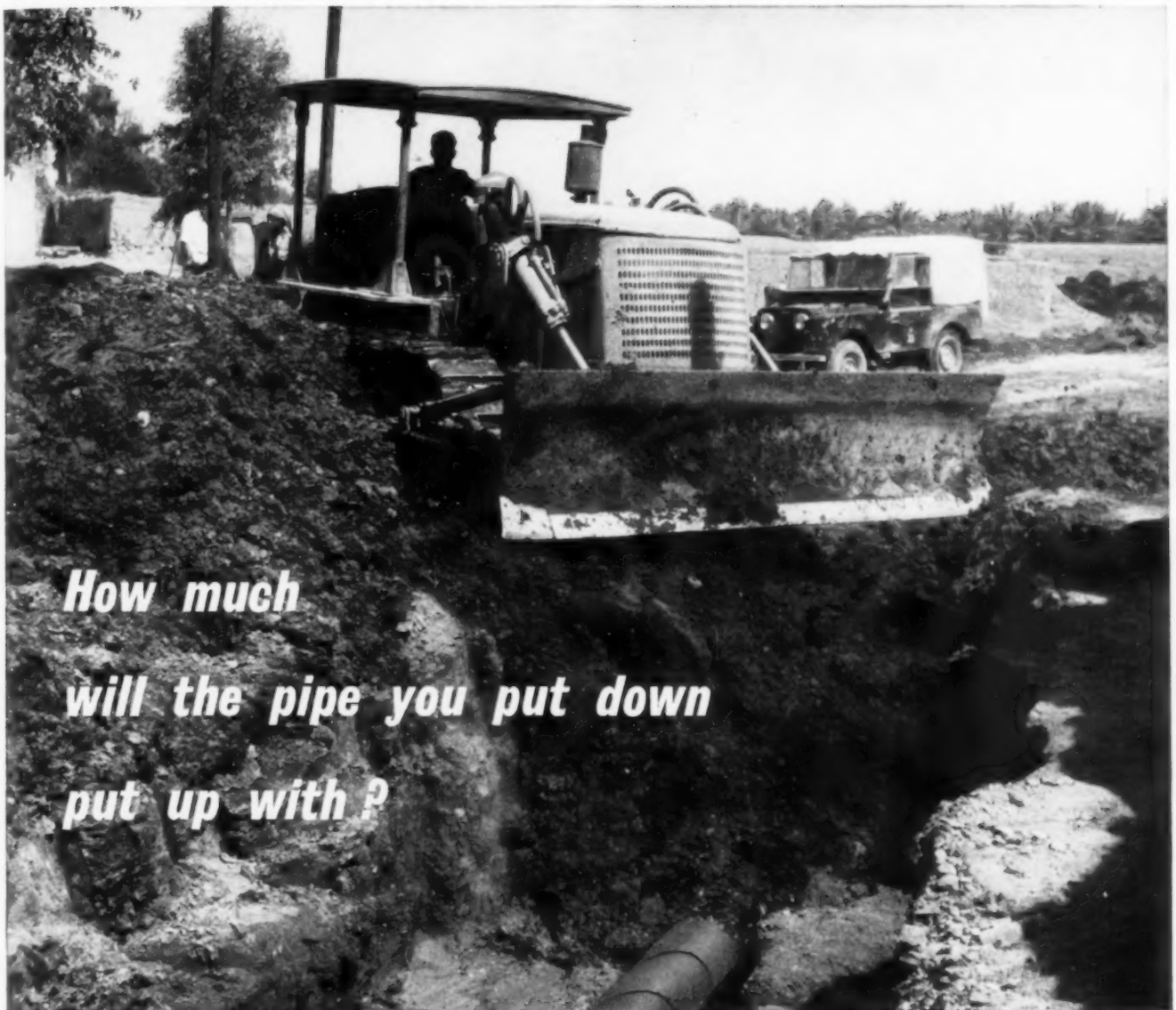

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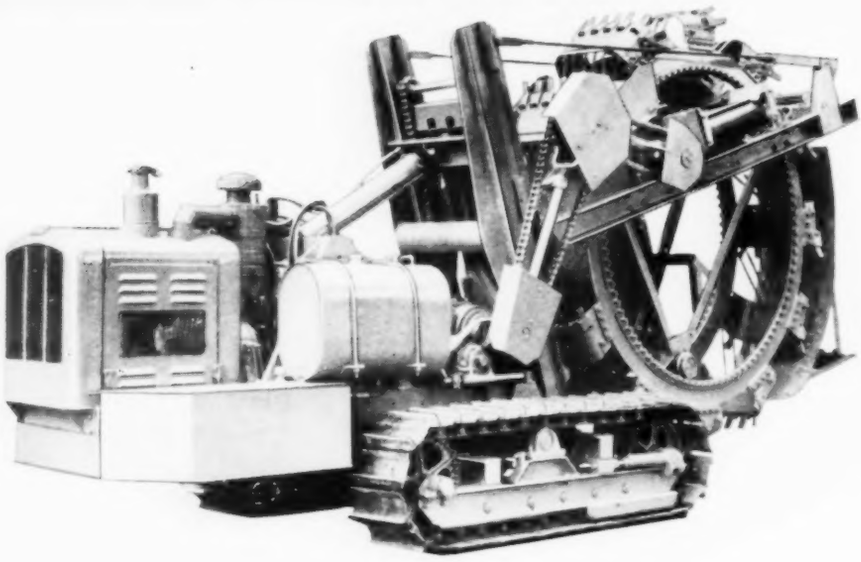
trench widths: 20 TO 32 INCHES



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- **wide wheel frame — cutting widths from 20 to 32"**
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- **hydraulically-driven conveyor — belt speeds independent of digging wheel speeds**
- **30 digging speeds from 12" to 25 lineal feet per minute**
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- **double-point "Tap-In" teeth — self-sharpening, reversible**
- **quick-change gumbo buckets**
- **retractable bucket-cleaner**
- **hydraulic wheel-hoist on power-tilt mast**
- **standard tractor crawlers — 16" grouser-type treads, or 12" flat shoes optional**
- **choice of gas or diesel power**
- **all main gears enclosed in oil bath; all main shafts on antifriction bearings**

Now, another wheel-type Trenchliner joins the big Parsons line — a new 170, with extra-wide wheel frame. Developed to meet the demand for wide work range in a medium-size machine, it digs up to *32 inches wide,* at depths to 5¾ feet. With all this extra capacity, you get smooth, positive wheel control.

Hydraulic power raises and lowers the wheel on vertical mast with fractional-inch accuracy — and tilts the mast for traveling or trailer-loading. New hydraulic control system on conveyor gives belt speeds up to 600 feet per minute — *completely independent of digging wheel speeds.* Belt easily handles maximum yardages from the extra-wide wheel — puts spoil bank well back beyond edge of trench. Better have Parsons distributor demonstrate what this new 170 will do for you!

Other sizes range from a smaller wheel model to "big-inchers" and "middle-inchers" — also, ladder-types on crawlers, and on rubber.

mail to: PARSONS Company, NEWTON, IOWA

Send us more information on new 170 wide-wheel Trenchliner

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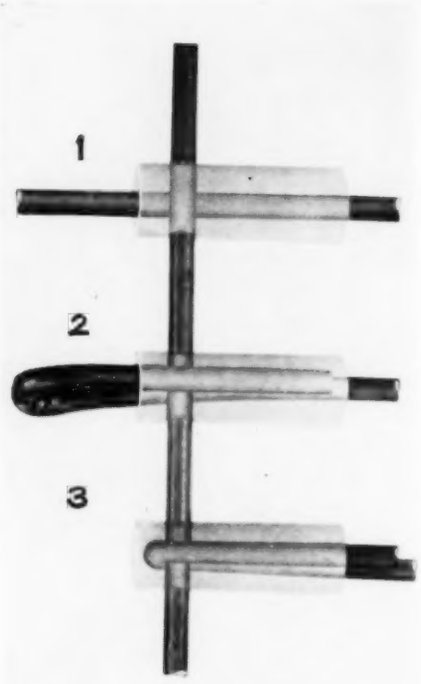


Plastic Connector

A plastic connector announced by Austin Powder Company provides a simple but effective method of hooking up detonating fuse preparatory to blasting.

When employed for joining trunk and branch lines, the connector assures a positive coupling that won't slip and also eliminates tying of knots. The detonating fuse is fastened in the connector in an easy three-step operation. First, the fuse from the shot hole is threaded through the length of the connector. The trunk line is pressed into the grooved slots and then the branch line is passed over the trunk line, returned the length of the connector and pulled tight.

For more data, circle **No. E11** on Readers' Service Card, last page this issue.

Gate Valves

Three new lines of Crane 600 class steel gate valves for oil and gas service have been announced by the Crane Company. They include a single-disc, conduit type pipeline valve, a double-disc, parallel seat pipeline valve and a smaller gate valve for general services. Both new pipeline valve designs are suitable for service with crude oil, refined petroleum products, and gas, at atmospheric temperatures.

The new Crane steel conduit valves will be furnished in sizes from 2-inch through 30-inch. Design features include one piece disc, with parallel faces, that requires no excessive stem thrust to effect tight seating, since line pressure does the work.

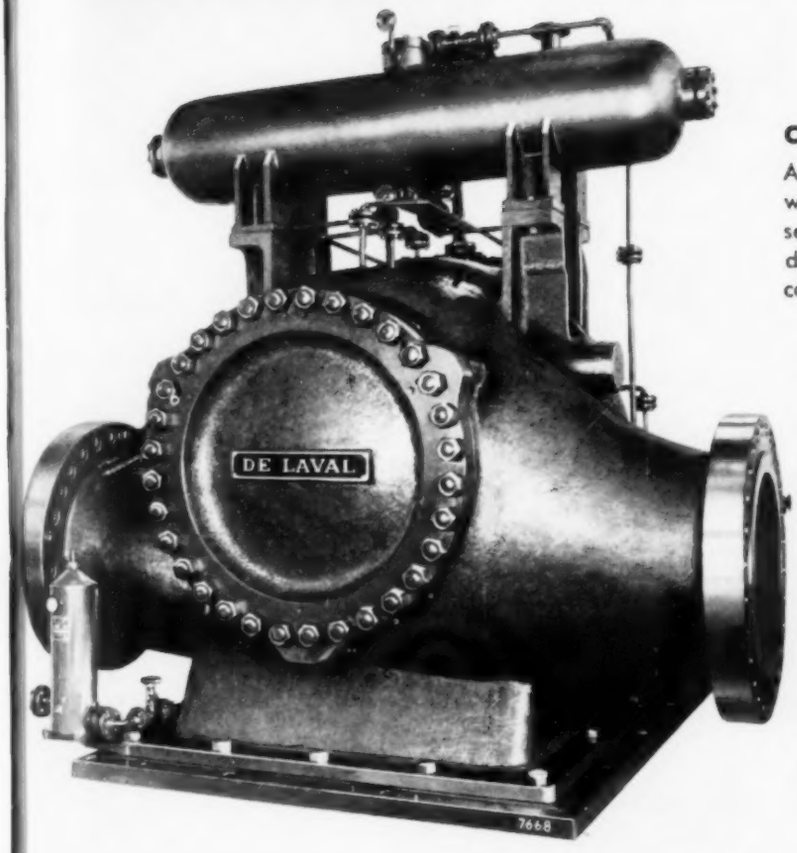
The new Crane double-disc parallel seat pipe line valve will be furnished in sizes from 2-inch through 24-inch. The valve is designed so that discs are free to rotate, changing their seating position at each closing, thus distributing wear more uniformly and prolonging the service life of the valve.

The new line of small Crane 600 class gate valves is available in sizes from ¼-inch to 2-inch.

For more data, circle **No. E12** on Readers' Service Card, last page this issue.

DE LAVAL
CENTRIFUGAL PIPELINE COMPRESSORS

come in two "packages" for easy installation



COMPRESSOR

A De Laval compressor with its emergency seal tank mounted directly on the compressor.

CONSOLE

The console contains the filters, motor-driven pumps, coolers, pressure switches, gauges and other accessories. It eliminates complicated piping on the packaged compressor . . . also serves as a protective cover for the equipment it houses.

ulletin 503 gives data on
De Laval centrifugal pipeline
ompressors. Write for your copy.

Designed in two packages, rugged De Laval centrifugal compressors offer many important engineering features. Among these are • high pressure contact shaft seal which eliminates gas leakage • heavy and rigid construction throughout • high load carrying capacity. The compressor and console arrangement makes De Laval centrifugal compressors easy to install—only simple low-cost foundations are required. De Laval units, totaling more than 280,000 horsepower, are now in operation on major pipelines.

DE LAVAL *Centrifugal Compressors*

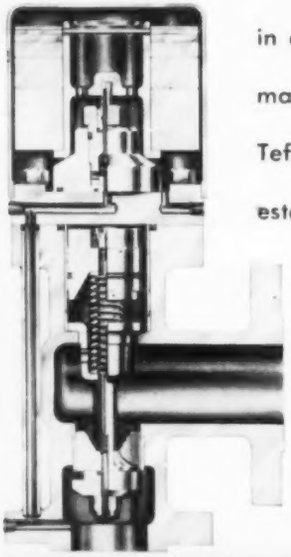
DE LAVAL STEAM TURBINE COMPANY
884 Nottingham Way, Trenton 2, New Jersey

The New Model 412 Kinzbach Pressure Relief Valve

The new, improved Kinzbach Model 412 relief valve for pipelines and refineries, has a ball seated pilot valve, usually dead weight loaded, but optionally spring loaded.

Eleven advantages are included in the design and operation of this new model:

1. Positive action—line pressure is utilized for opening and closing.
2. Dependable. Opening pressure is pre-set by application of dead weight or spring load.
3. Instantaneous opening to full capacity.
4. Automatic reseating.
5. No chatter or wire-drawing at seat.
6. Functional Testing. Hand lifting of pilot stem operates valve at any pressure.
7. Simple and rugged. Valve contains only two moving assemblies.



8. High capacity. Ample flow area provided in all sizes.
9. Positive Seating. Line pressure utilized to maintain valve shut.
10. Corrosion resistant. Full stainless trim with Teflon disk.
11. No pressure accumulation needed. Full lift established immediately.

Model 412 Valve sizes are 2", 3", 4", 6" and 8" with working pressures up to 1000 p.s.i.; pilots are available in four ratios: 5:1, 10:1, 25:1, and 50:1. For complete details on this and other Kinzbach pressure relief valves, write for new catalog.

KINZBACH TOOL CO INC

Export Office:
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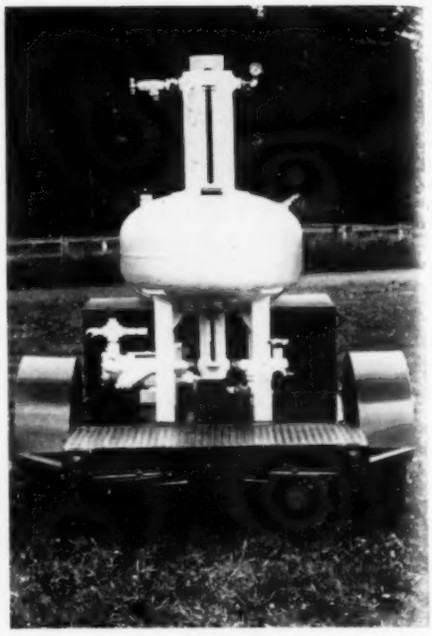
KINZBACH TOOL CO., INC., P. O. BOX 277, HOUSTON, TEXAS



Meter Prover

Pressed Steel Tank Company has announced it is now in production on the LP-Gas liquid meter prover. The prover operates on the volumetric principle and is composed of an ASME vessel designed for 250-pound pressure. Integral upper and lower gauge glasses are provided to determine the starting or "zero" point on the lower glass and the reading of the total gallonage delivered into the prover on the upper gauge glass. Graduated scales are provided on the gauges to determine the variations of the metered input and allow checks against established tolerances.

The prover is equipped with all necessary relief valves, pressure gauge, excess flow check valves, shutoff valves, thermometer well, levels for establishing levelness of unit, strainer, wire braid flexible connections, extra heavy pipe, forged steel pipe fittings and hose connections for efficient and safe operation. An electrically operated LPG pump with 100 feet of extension cord is included for evacuating the prover back to the supply tank. Hoses for vapor equalizing and evacuation are provided.

For more data, circle **No. E13** on Readers' Service Card, last page this issue.

Helmet

American Optical Company announces a new aluminized plastic cover plate for welding helmets, and a new aluminized cellulose acetate face shield window, for protection against radiant heat. Windows enable welders to work longer and with greater efficiency. Plates are exceptional for inert gas shielded arc welding. Both are treated with an evaporated aluminized coating, which reflects more than 70 percent of radiant heat normally reaching the welder's face.

Field tests have shown that aluminized windows last over four times as long as those which are untreated. Aluminized windows are available for all AO face shields of the "H" series, and on other types by special order. Aluminized cover plates are 2 x 4¼ size.

For more data, circle **No. E14** on Readers' Service Card, last page this issue.

A high-performance crawler excavator

the ALLEN model C16

This British-built ½ cu. yd. machine is one of the latest in the ALLEN range of HIGH QUALITY excavators.

It can swing, hoist, and travel all at the same time, thus reducing working time on many jobs. Smooth, air-controlled clutches give fast working and a high output comparable with many larger machines.

Write for full particulars.

Air-controlled segmental clutches for light handling and easy replacement. All drums and shafts on ball bearings. Power unit—the Gardner 4 LW oil engine. Two forward travel speeds. Can be equipped as crane, clamshell, dragline, shovel or trench hoe.

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CORROSION: Causes and Prevention

By Frank N. Speller

This third edition offers a simple, easy-to-understand explanation of the mechanism of corrosion and of the practical methods of prevention. It deals extensively and specifically with the nature and theories of corrosion, influence of methods of manufacture and treatment, influence of factors internal and external to metal, principles of corrosion testing, prevention of corrosion in the atmosphere, underwater, in closed systems, in steam generators, in steam and heating systems and in underground systems. Stray-current corrosion (electrolysis) and cathodic protection.

1951, 664 pages.....Price $11.00

PIPELINE CORROSION AND CATHODIC PROTECTION

By Marshall E. Parker

This book is designed as a practical field manual. It contains comprehensive material on soil resistivity surveys, potential surveys, line currents, current requirements, rectifier systems, ground bed design, magnesium anodes, stray current electrolysis, interference in protective systems, operations and maintenance, and coating protection and testing. The appendix provides data on underground corrosion, basic principles of cathodic protection, properties of metals and attenuation equations.

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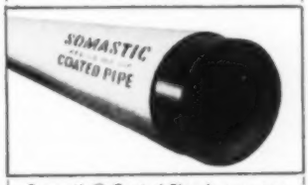

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Here's why many major pipe line companies are asking for the new Lowell #50-A Wrench.

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Other reversible ratchet wrenches available with handles up to 36" lengths.

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Wagon Drill

Schramm, Inc. has announced an improved wagon drill which features long feed travel, a new down-pressure motor and line oiler and a full range of feed pressures. Known as the Schramm DR-126-A, this drill employs a standard Schramm 4-inch drifter with 10-foot feed travel for 8-foot steel changes—an improvement over the previous 8-foot travel for 6-foot steels.

Other features include a double-cylinder, seven-blade air motor. This high-torque motor runs evenly with 14 impulses per revolution. Supply air can be throttled for an infinite number of feed pressures. A two-gallon capacity line oiler is arranged so that a motor for the U-bar or any other equipment can be lubricated. At the lower end of the air shell is a Schramm Centralizer which prevents the drill from "walking" when a hole is started.

(This item supplements Schramm, Inc. data on Pages 346-347 of the Pipe Line Composite Catalog, 1st Edition.)

For more data, circle **No. E15** on Readers' Service Card, last page this issue.

Weed Killer

A chemical weed killer capable of eradicating the hard-to-kill Johnson, Bermuda and other weed grasses with a single application has been announced by General Chemical division, Allied Chemical & Dye Corporation. The product is known as Hexachloracetone and is being marketed in a number of formulations under the trade name HCA Weed Killers for use in non-crop areas.

HCA is designed for use with ordinary weed oils. It prevents resprouting of noxious grasses by killing the roots, gives full season control when applied at almost any time of the year and kills weeds without sterilizing the soil. In addition, HCA in oil gives immediate results by "killing back" top growth in from 12 to 48 hours after spraying.

For more data, circle **No. E16** on Readers' Service Card, last page this issue.

FOR OVER 20 YEARS the versatile Cleveland "110"...here's one working on a gas gathering line for Phillips Petroleum in McClain County, Okla. . . . has been a fast dependable trencher on gas, oil, and product pipelines of all types, to 24 inches wide and 5½ feet deep . . . trunk lines, gathering lines, field lines, lease lines. Built tough and compact, the "110" is a perfectly balanced combination of practical, performance-proved features . . . a trencher of superior digging ability in all types of soil and terrain. It digs more trench in more places at less cost.

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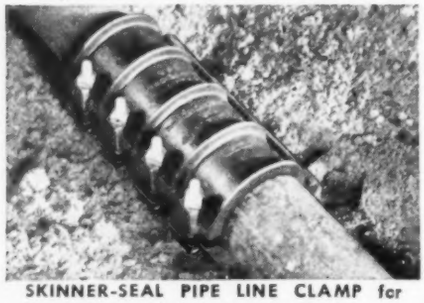

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2061 N. Southport, Chicago, Ill.
CATALOG NUMBER 569-P 9

New Equipment Literature

For more data on New Equipment or copies of Catalogs and Literature reviewed in this issue, use the Reader Service postcards just inside the back cover and facing the Advertisers Index. Simply circle code numbers of items desired—sign and mail card.

Crawler Tractors

An eight-page folder showing use of the International Harvester Company's crawler tractor line has been made available. "Picture Proof of International Superior (Sideboom) Power" is exhibited in on-the-job photos showing the IH Superior-side-boom-equipped rigs working on various phases of the pipe-laying job-cycle. Close-ups and descriptions of such important features as load and boom brakes, drum clutches and conveniently located operator control levers complete the booklet.

To get a copy, circle **No. E17** on Readers' Service Card, last page this issue.

Valves, Hydrants

A 244-page catalog covers Darling gate valves, check valves and fire hydrants in a broad range of types, sizes and constructions. The new issue supersedes Darling Catalog No. 17. In addition to describing the company's latest developments, information is included on extensive engineering data, application tips, valve accessories information and reference data on materials, specifications and standards.

To get a copy, circle **No. E18** on Readers' Service Card, last page this issue.

Electric Plants

D. W. Onan & Sons Inc. has revised their "Blue Book" of general information concerning the selection of engine driven electric generating plants and tracing the history of electric plant development. Described in simple language are the three general groups of electric plants including Alternating Current, Direct Current and Battery Charging. Plant operation and types of prime mover are also reviewed.

To get a copy, circle **No. E19** on Readers' Service Card, last page this issue.

Catalog

Shand and Jurs Company has announced the availability of revised pages for the General Catalog 52-D. The additional pages are loose leaf and are easy to place in the book. The company has also issued two special brochures on the S&J Gardtrol products, valve and motor monitors. Another brochure in color describes Berkeley, where S&J products are made.

To get a copy, circle **No. E20** on Readers' Service Card, last page this issue.

Tape Wrapping

A four-page illustrated brochure from Plicoflex, Inc. gives specifications and construction details on the two power operated models and three manually operated models of Plicoflex "Speedmaster" Tape Wrapping Machines.

To get a copy, circle **No. E21** on Readers' Service Card, last page this issue

Fans

Aerovent Fan Company, Inc. has published a 24-page Air Engineering Data File (Bulletin E-57) covering engineering and test facilities for propeller fans, specifications, construction, maintenance and installation. Helpful tables for estimating air-handling requirements, entrance and elbow losses and duct sizes are found in this new folder. Also included are specifications for special application equipment.

To get a copy, circle **No. E22** on Readers' Service Card, last page this issue.

Record Gages

Rockwell Manufacturing Company has issued a revised eight-page bulletin covering its broadening line of combined record gages for large-volume gas measurement. Featured in the pamphlet are installation photos and cutaways along with current general information on this category of gas measurement.

To get a copy, circle **No. E23** on Readers' Service Card, last page this issue.

Wire Rope

The bulletin, Wire Rope Recommendations for General Contractors, has been prepared by the American Cable Division, American Chain & Cable Company, Inc. Describing the manufacturer's complete line of Tru-Lay preformed wire rope, wire rope accessories and Dualoc boom cable assemblies, this 16-page booklet contains data on construction features, applications and diameters.

To get a copy, circle **No. E24** on Readers' Service Card, last page this issue.

Plug-In Busway

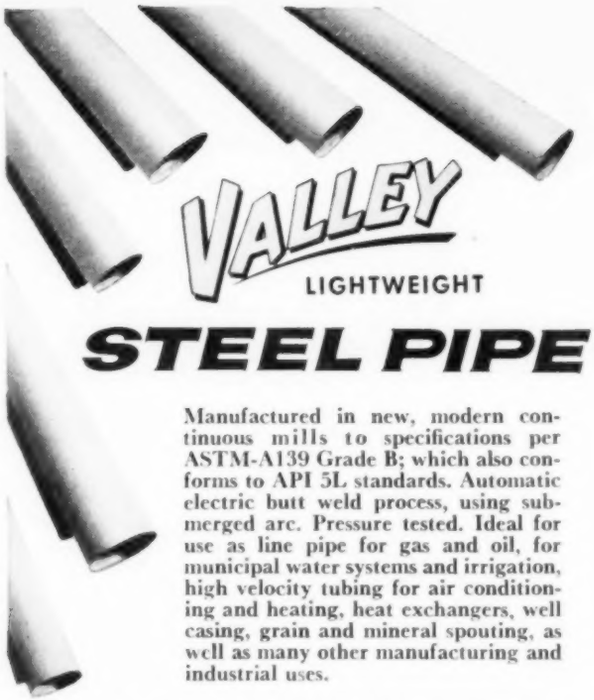
A plug-in busway, designed primarily to serve as feeders for lighting and power loads, is the subject of a revised 20-page bulletin issued by General Electric's Distribution Assemblies department. The publication describes the functions, applications and features of Type FVK plug-in busway and lists ratings, weights, technical data, installation data and guide form specifications.

To get a copy, circle **No. E25** on Readers' Service Card, last page this issue.

Motor Starters

Allis-Chalmers Manufacturing Company's complete line of motor starters and contactors in sizes 4, 5 and 6 (Type 425), 50 to 400 horsepower, is described in a 12-page bulletin recently released by the company.

To get a copy, circle **No. E26** on Readers' Service Card, last page this issue.



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Available in 6", 6⅝", 8", 8⅝", 10", 10¾" diameters, from 16 gauge up to and including .188 wall thickness; 20, 30 or 40-foot lengths; and in plain or belled ends. Quotations available for Victaulic or Dresser end processing, and coating.

Available for immediate delivery.

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VALLEY **Manufacturing Company** Valley, Nebraska

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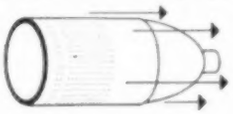
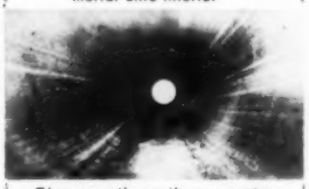


Liner compresses cement mortar onto interior



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Tate Process applies cement mortar lining to the interior of 4" to 16" lines quickly and economically . . . while the lines stay "in place." Permanently restores full flow coefficients. Reduces pumping and maintenance costs. Protects against corrosion, contamination.

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• Tate and Centriline "In Place" Interior Cement Mortar Lining • "In Plant" and "Railhead" Centrifugal Spinning of Cement Mortar or Coal Tar Linings – Somastic® Exterior Coating • Pipe Wrapping • Reclamation: Removal of Old Wrapping, Straightening, Blasting, Beveling, Testing.

PIPE LININGS Inc.

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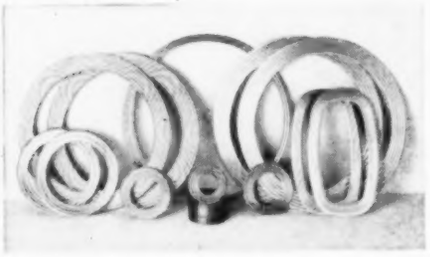

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THE HOMOGENIZING FUEL OIL TREATMENT

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Advertisers' Index

• Dot preceding name of advertiser indicates that detailed data on products and services of the firm will be found in current 1st (1957-58) edition of The Pipe Line Composite Catalog.

A

• ACF Industries, Inc. 97
Acme-Newport Steel Co. 95
The Air Preheater Corp. 98-99
• Alco Products, Inc. 59
John Allen & Sons (Oxford) Ltd. 113a
American Recording Chart Co. 68
American Sand-Banum Co. 118b
American Telephone & Telegraph Co. 14
Anaconda Wire & Cable Co. 85

B

B-I-F Industries, Inc. 20
• Bethlehem Supply Co. 101
Black, Sivalls & Bryson, Inc. 102
Braden Winch Co. 88
Brakesol, Inc. 117b
Ralph N. Brodie Co. 11
• Bucyrus-Erie Co. 22
Builders-Providence, Inc.
Division B-I-F Industries, Inc. 20

C

The Philip Carey Mfg. Co. 12
Chicago-Wilcox Mfg. Co. 118a
• Clark Bros. Co. 76
The Cleveland Trencher Co. 115a
Collins Construction Co. 26
Cosasco Division
Perfect Circle Corp. 21
Crane Packing Co. 84
• M. J. Crose Manufacturing Co. 73
Crouse-Hinds Co. 17

D

De Laval Steam Turbine Co. 111
• Dresser Industries, Inc. 76

E

E-I-M Company 91
Thomas A. Edison Industries, Inc. 16
• Allan Edwards, Inc. 114b
• Elliott Company 89

F

Fibreglass Limited 109
Fleet-Line Co. 86
• Fluor Products Co. 121

G

Garrett-Bromfield & Co. 117d
• Gaso Pump & Burner Mfg. Co. 122
• The Gulf Publishing Co. ..... 108b and 113b

H

• H & M Pipe Beveling Machine Co. 2
• Homelite Division
Textron, Inc. 82-83
Houston Contracting Co. 66
• Humble Oil & Refining Co. 7

I

• Ingersoll-Rand Co. 13
Insley Manufacturing Co. 10
International Harvester Co. 18-19

J

• Johns-Manville Corp. 107
Justrite Manufacturing Co. 116b

K

Kern Instruments Inc. 108a
• Kinzbach Tool Co. 1 2
Koppers Company ..... 24 and 1 5

L

LimiTorque Corp. 1 4
Lone Star Steel Co. 5
Lowell Wrench Co. 11 4

M

• The Mercoid Corp. 52
• Mixing Equipment Co. 62

O

• Oil Well Supply Division
United States Steel Corp. 5

P

• Panellit, Inc. 70
Parsons Co. 110
Tod Pazdral Pipeline Specialties 96
• Pelican Supply Co. 118c
Perfect Circle Corp. 21
Philadelphia Gear Works, Inc. 80
• Pipe Line Composite Catalog 74-75
Pipe Line Technologists 64
Pipe Linings, Inc. ..... 113c and 117c
Pittsburgh Coke & Chemical Co. 25
• Pittsburgh-Des Moines Steel Co. 71
H. K. Porter Company, Inc. 100

R

Rockwell Manufacturing Co. 15
Royston Laboratories, Inc. 8

S

Shand & Jurs Company 93
• M. B. Skinner Co. 116a
• Steel Forgings, Inc. 86

T

• Textron, Inc. 82-83
• Tretolite Co. 87
• Tube Turns 9
Tulsa Winch Division
Vickers, Inc. 104

U

United States Steel Corp. 5

V

Valley Manufacturing Co. 117a
Vickers, Inc. 104

W

• W-K-M Division
ACF Industries, Inc. 97
W-S Fittings Division
H. K. Porter Company, Inc. 100
Walworth Co. 69
Westinghouse Electric Corp. 23
Whitlock Manufacturing Co. 115b
Wilkening Manufacturing Co. 65
Williams Brothers 81
T. D. Williamson, Inc. 106
Wisconsin Motor Corp. 90

Y

Young Radiator Co. 94
The Youngstown Sheet & Tube Co. 67

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24 25 26 59 62 64 65 66 67 68 69 70 71 73 74 75 76 80 81 82
83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102
104 105 106 107 108a 108b 109 110 111 112 113a 113b 113c 114a 114b 115a 115b 116a 116b 117a
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PIPE LINE INDUSTRY Readers' Service Card **September, 1957, Issue***

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24 25 26 59 62 64 65 66 67 68 69 70 71 73 74 75 76 80 81 82
83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102
104 105 106 107 108a 108b 109 110 111 112 113a 113b 113c 114a 114b 115a 115b 116a 116b 117a
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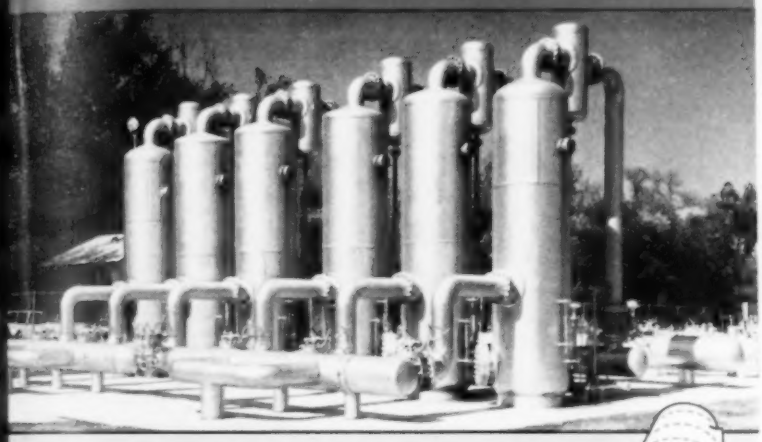
Quick-Easy

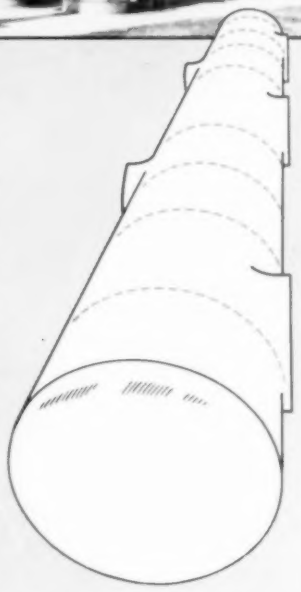
Use these cards to help keep informed on what's new . . . for more job-help information on equipment and services.

How Oklahoma Natural compounded savings by specifying cold extrusion



Oklahoma Natural Gas Company compounded installation savings at their South River Station, Tulsa, by (1) designing for multiple outlet headers and, (2) specifying Fluor-formed headers with cold extruded outlets.

The diagram at the right shows how each of the four 20″ O.D. headers at the South River Station eliminated five 20″ × 20″ × 12″ reducing outlet tees and eight 20″ welds (indicated by broken lines on diagram)—a total saving of 20 tees and 32 welds!



By specifying Fluor-formed headers with cold-extruded nozzle outlets, these added savings were realized

1. IMPROVED STRENGTH & DURABILITY—Polished extrusion dies impart a smooth, dense surface finish to the outlet—assurance of longer service life where vibration or pulsation stresses are involved.

2. CLOSER DIMENSIONAL TOLERANCES—Flowing steel under compression while in a tough stable condition permits extremely close tolerance dimensional configurations—center-to-center and centerline location tolerances are easily held within .060″.

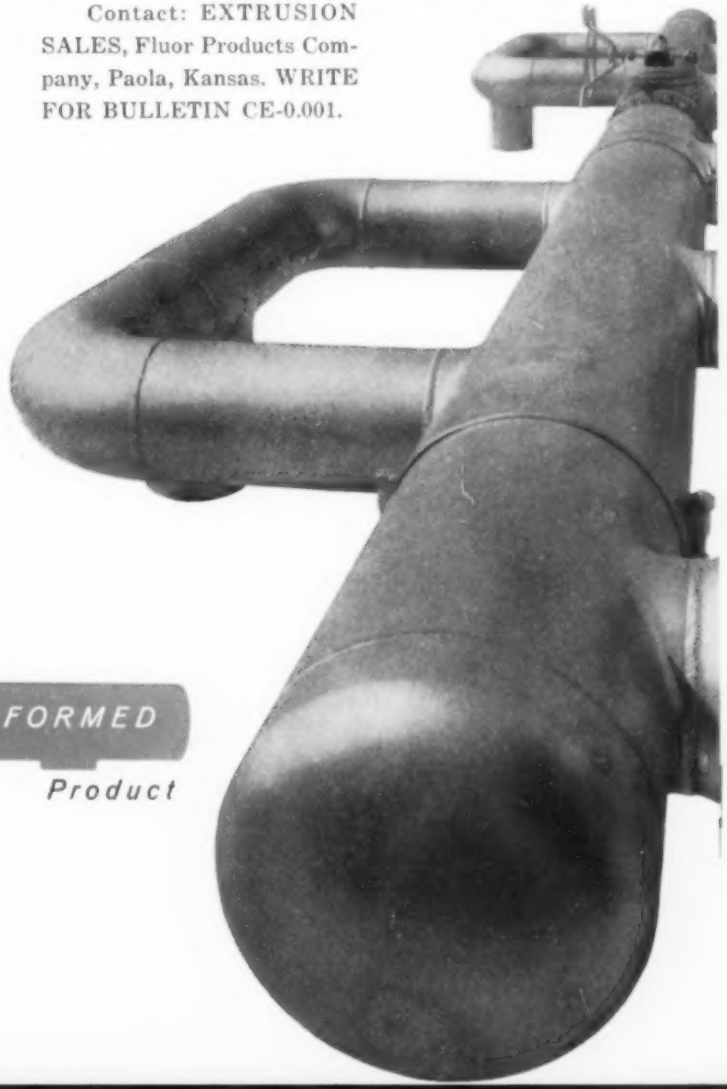
3. LESS MATERIAL NEEDED—Fluor-formed cold extruded multiple outlet headers need no extra length for manufacture—they are made to the exact length and wall thickness required.

4. NO DELAYS—Because nozzle outlets are cold extruded, headers are often made from stock or from the same pipe used elsewhere in a job—production is faster, inspection is simpler.

DIFFICULT JOBS A SPECIALTY

Many difficult design problems can be solved by cold extrusion techniques. Qualified Fluor Products Company engineers are ready to furnish you specialized technical information on how this process can be utilized to save you time and money.

Contact: EXTRUSION SALES, Fluor Products Company, Paola, Kansas. WRITE FOR BULLETIN CE-0.001.



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ASSOCIATES: Fluor Corporation of Canada, Ltd., Toronto; Head-Wrightson Processes, Ltd., London, England.

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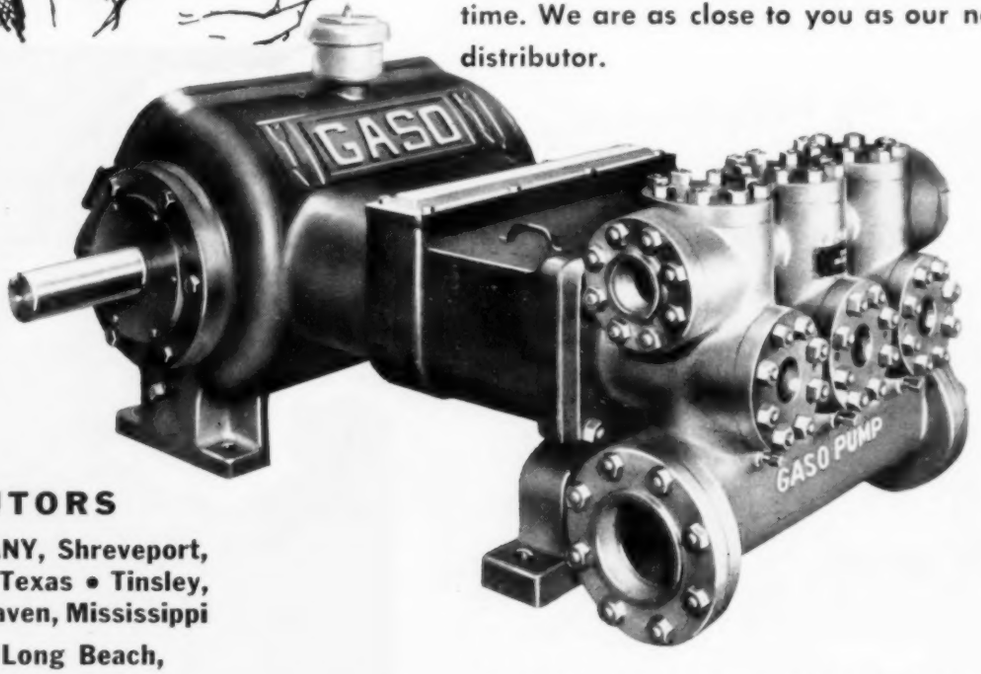

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